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THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
)
Leonel Yanez MARTINEZ et al.)
)
)
Serial No. 10/613,433)
)
Filed: JULY 3, 2003)
)
Title: **DRY WATER RESISTANT**)
COAXIAL CABLE AND METHOD)
OF MANUFACTURE THEREOF)
)
)
Docket No. MX/JFServ-001)

Group Art Unit: 2831

Examiner: William Mayo II

APPELLANTS' BRIEF
UNDER 37 C.F.R. §41.37

Assistant Commissioner for Patents
Washington D.C. 20231

REQUEST FOR *EN BANC* OR REVIEW BY AN ENLARGED
BOARD OF APPEALS

Sir:

This is responsive to the Final Rejection dated August 5, 2010 in the above-identified application. Appellants have initiated a new Notice of Appeal and Appeal Brief in accordance with 37 CFR 41.31. Attached is the Appeal Brief pursuant to 37 C.F.R. §41.37. Appellants request to reinstate any previously paid Appeal Brief fees. MPEP §1204.01; 37 CFR §41.20.

Appellants request that the Appeal Brief be reviewed *en banc* or by an enlarged Board of Appeals for the following reasons:

The present application was filed on July 3, 2003 and published on January 27, 2005 as US 2005-0016755 A1. The application has been undergoing examination for **more than 7 years**.

First, EP03254294.6 pending patent application which was filed on July 7, 2003, **issued on March 21, 2007, as EP 1457996** (attached). This information was conveyed to the Examiner

on March 9, 2009. All of the cited prior art in the issued EP1457996 were all directed to **coaxial cables** for use in **communication cables** (Discussion below). None of the cited prior art by USPTO Examiner were directed to coaxial cable for use as communication cable. None of the prior art disclose or suggest coaxial cables.

On July 15, 2008, The Board of Appeals denied the Appellants' appeal and stated that the Examiner has established obviousness of Claims 11-27 and that the cited prior art by the Examiner, e.g., Chan, U.S. 5,486,648 clearly describes all of the limitation set forth in the claim including the adhesive in the first polymer layer and that Goehlich, U.S. 6,784,371 are merely cumulative to teachings in Chan et al. The Board stated that Claim 22 which recited external conductor thickness of at least 0.2 mm and diameter of 14.2 mm in the Appellants' application were taught by Belli, U.S. 6,455,769 and would involve only routine skill in the art. Board Decision, item 4 page 4 citing Examiner answer. (Appellants are addressing this issue below)

On September 18, 2008, the Appellants filed a new set of claims in the present patent application. The new set of claims have been **substantially narrowed** and recited the limitation **"consisting of."** **These claims are the same set of claims which were granted in Europe on March 21, 2007.**

The Examiner continued to reject the substantially narrowed new set of Appellants' claims over the same prior art, Chan, U.S. 5,486,648, Goehlich, U.S. 6,784,371 and Belli, U.S. 6,455,769. Again, Appellants appealed the rejection of the pending new set of claims with the limitation **"consisting of"** on November 11, 2009. The Examiner Answer issued on February 18, 2010. Appellants filed a Reply brief with a one month extension of time on June 7, 2010. The Reply Brief was not entered because extension of time was not allowed for filing Reply Briefs.

On June 1, 2010, Appellants Petitioned the Examiner's indefiniteness rejection and issuance of new prior art in Final rejection. A Supplementary Petition was filed on July 22, 2010 regarding indefiniteness issues and new prior art cited in Examiner Answer. The Petition was granted on August 16, 2010.

On August 5, 2010, the Examiner reopened the prosecution and issued a Final rejection. Appellants did not understand why the prosecution was reopened. Appellants are filing this Appeal without payment of fees. MPEP §1204.01; 37 CFR §41.20. In addition, any after final amendment or affidavit or other evidence, e.g. Reply Brief, which was **not entered before must be entered and considered on the merits.** MPEP§1207.04

This appeal involves a **dry, water resistant, coaxial cable for use in communication cable, e.g. cable TV for signal transmission.** In order to connect coaxial cables to transmission or reception equipment, it is necessary to prepare a coaxial cable and then seal the connectors to prevent water penetration. The problem is that due to poor sealing, inadequate cable installation results. Current methods to prevent water penetration use fillers and oil dispersed water insoluble materials and stabilizers based on glycol, ester acetate, ethylene glycol ester or ethylene glycol ester acetate.

The Appellants have developed a technique through a design of dry cable, i.e., without the use of filler, but incorporates the water penetration prevention element which permits to prepare and connect coaxial cable without using solvents and other cleaning elements.

Moreover, Appellants used low density polyethylene which is different and unobvious over the cited prior art by the Examiner which uses crosslinked polyethylene, as discussed below.

It is submitted that an understanding of the cited references by the Examiner and of Appellants' invention are essential to correct the resolution of the instant application.

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I. REAL PARTY IN INTEREST

The real party in interest in the appeal is the assignee, Servicios Condomex S.A. de C.V., pursuant to Assignment recorded in the United States Patent & Trademark Office on July 3, 2003 on Reel 013274, Frame 0172.

II. RELATED APPEALS AND INTERFERENCES

Based on information and belief, there are no such appeals or interference which will directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 68-75 are pending. Claims 68-77 were subjected to a restriction requirement. Appellants elected Claims 68-75, directed to coaxial cables, with traverse. Claims 76-77, directed to method claims and dependent on Claim 68, were withdrawn from consideration. Appellants request that Claims 76-77 be held in abeyance pending decision of the appeal. If product claims of Group I are allowed, Group II, directed to process claims and dependent from allowed product claims should be rejoined. MPEP 831.04.

Claims 68-75 stand rejected.

Claims 68-75 are appealed.

Claims 68-75 are listed in the attached Appendix.

IV. STATUS OF AMENDMENTS

Earlier amendments, claims 68-77 filed on March 9, 2009, all prior to the final rejection have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

In its broadest scope, Appellants' invention relates to a dry, water resistant coaxial cable (10) (Figs 1-2; page 3, lines 1-13; 20; page 5, lines 4-11) **consisting of:**
a metal core conductor element (11); (Figs 1-2; page 3, lines 1-9; 21; page 5, lines 12-18)
a dielectric element around the core conductor based on three layers,

the first layer (12) (Figs 1-2; page 3, lines 1-9; 14-25; page 5, lines 19-25 to page 6, lines 1-6; page 8, lines 24-25 to page 9, lines 1-6) being applied onto the conductor as a uniformly thick film based on low density polyethylene mixed with a vinyl or acrylic adhesive (page 3, line 25 to page 4, lines 1-3; lines, 11-13; page 6, lines 3-5; page 8, lines 20-23; page 10, lines 1-5), the second layer (13) (Figs 1-2; page 3, lines 1-9; page 6, lines 6-16; page 9, lines 14-20; page 10, lines 1-5) being based on an expanded polyethylene mix consisting of low density polyethylene or mixture of low, medium and high density polyethylenes (page 13, lines 12-14; lines 21-23) and a swelling agent selected from azodicarbonamide, p-toluene sulphonylhydrazide, or 5-phenyltetrazol, (page 4, lines 7-9; page 6, lines 14-16; page 9, lines 10-12) and optionally, a reinforcement layer (14) (Figs 1-2; page 3, lines 1-9; page 6, lines 16-25; page 9, lines 17-20) of the same characteristics as the first layer (12) (Figs 1-2; page 3, lines 1-9; page 13, lines 18-21); wherein it has a second external conductor element (15) (Figs 1-2, 4; page 3, lines 1-9; 14; page 4, lines 16-25; page 6, line 25 to page 7, lines 1-7; page 12, lines 3-7; page 14, lines 1-4) formed by a tape made of an aluminum or copper alloy or combined with other elements (page 4, lines 17-19; page 5, lines 13-15; page 10, lines 14-16) and surrounding said conductor consisting of a water penetration protective element (16) (Figs 1-2, 4; page 3, lines 1-9; page 7, lines 8-15; page 12, lines 3-7; 9-10; page 14, lines 6-7) keeping it dry and based on one or several swellable fibers or tapes formed by polyester threads or other swellable fibers (Figs. 1-4; page 3, lines 1-9; page 10, lines 17-21; page 12, lines 5-9); and the protective cover (17) (Figs 1-2, 4; page 3, lines 1-9; 15; page 3, line 25 to page 4, lines 1-3; page 7, lines 16-25 to page 8, lines 1-3; page 12, lines 11-17) based on low, medium, high density polyethylene or a combination thereof (page 4, line 25 to page 5, lines 1-3).

Claim 69 The dry coaxial cable according to claim 68 wherein the core conductor is copper plated aluminum wire, with a uniform circular cross section of 3.15 ± 0.03 mm diameter. (Specification, page 13, lines 1-4; Figs.1-2).

Claim 70 The dry coaxial cable according to claim 68 wherein the adhesive component is chosen between ethylene acrylate acid or ethylene vinyl acid permitting better adherence and water resistance between the core conductor and the dielectric element. (Specification, page 3, lines 23-

25; page 4, lines 9-15; page 6, lines 3-12; 20-25)

Claim 71 The dry coaxial cable according to claim 68 wherein the second polyethylene film applied onto the core conductor shows better watertightness to the swellable dielectric improves its superficial appearance and offers a 13.0 ± 0.10 mm diameter. (Specification, page 13, lines 16-17; Figs. 1-2)

Claim 72 The dry coaxial cable according to claim 68 wherein the external conductor is formed by a tape made of aluminum or copper alloy or mixture thereof is formed in a cylindrical pipe and can be longitudinally welded, extruded or the edges can be overlapped and it has a thickness of 0.34 mm and the diameter on the pipe is 13.7 ± 0.10 mm diameter. (Specification, page 4, lines 16-20; page 14, lines 1-4; Figs. 1-2).

Claim 73 The dry coaxial cable according to claim 68 wherein the water penetration protective element consists of swellable tapes placed helically, annularly or longitudinally. (Specification, page 3, lines 15-19; page 4, lines 20-25; page 12, lines 4-9; Figs. 1-2).

Claim 74 The dry coaxial cable according to claim 73 wherein the moisture protection elements have an absorption speed of ≥ 15 ml/g per minute and their absorption capacity is over 30 ml/g. (Specification, page 14, lines 5-9; Figs. 1-2)

Claim 75 The dry coaxial cable according to claim 68 wherein the external cover is made of medium density polyethylene and has a diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness. (Specification, page 14, lines 17-18; Figs. 1-2).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issue on appeal are:

- a) Whether or not Claims 71-72, 74 and 75 are properly rejected as being indefinite under 35 U.S.C. §112.
- b) Whether or not Claims 68-75, directed to dry, water resistant coaxial cable were properly rejected as being unpatentable under 35 U.S.C. §103(a) over Chan et al. (U.S. 5,486,648) in view of Goehlich (U.S. 6,784,371) and further in view of Belli (U.S.6,455,769).
- c) Whether or not each of Claim 68, 69, 70, 71 72, 73, 74 and 75 was properly rejected as being unpatentable under 35 U.S.C. §103(a) over Chan et al. (U.S. 5,486,648) in view of Goehlich (U.S. 6,784,371) and further in view of Belli (U.S.6,455,769).

VII ARGUMENT

A.The rejection of the claims under 35 U.S.C. §112 as being indefinite should be reversed because the specification disclosure shows the claim limitations are definite.

The claims do not stand or fall together. For purposes of 35 U.S.C. § 112, each of Claim 71, Claim 72, Claim 74, and Claim 75 stands apart from each other.

It is submitted that the "second polyethylene film" in Claim 71 is definite. In this regard, Claim 68 recited that the second polyethylene film as the reinforcement layer with same characteristics as the 1st layer. The specification provided that "the diameter of the third layer is similar to 1st layer with a 13.0±0.10 mm dia." See page 4, lines 14-16; page 6, lines 17-25; page 13, lines 15-24.

It is submitted that the "external conductor" in Claim 72 is definite. In this regard, Claim 72 recited the external conductor is formed by tape made of an aluminum or copper alloy or combined with other elements." The specification provided that "the external conductor has a thickness of 0.34 mm and 13.7±0.1 mm dia." See page 4, lines 17-20; page 6, line 25 to page 7, lines 1-8; page 14, lines 3-5.

It is submitted that the "moisture protection elements" in Claim 74 is definite. In this regard, Claim 74 recited the "moisture protection elements" have an absorption speed of > 15 ml/g per minute and their absorption capacity is over 30 ml/g. The specification provided that the water penetration protective element has an absorption speed is > 15 ml/g per minute and the absorption capacity is over 30

ml/g. Moreover, the specification provided that the water penetration protective element 16 is applied helically, annularly or longitudinally. See page 4, lines 22-24; page 7, lines 8-15; and page 14, lines 5-9.

It is submitted that the "external cover" in Claim 75 is definite. In this regard, Claim 75 recited the protective cover is based on low, medium, high density polyethylene or a combination thereof. The specification provided that the cover is 15.5 mm \pm 0.10 mm with 0.67 mm \pm 0.02 mm thickness. See page 4, lines 25 to page 5, lines 1-3; page 7, lines 16-25; and page 14, lines 17-18.

Applicants submit that claim indefiniteness is analyzed "*not in a vacuum*, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by a person possessing the ordinary level of skill in the pertinent art (POSA);" **the failure to provide explicit antecedent basis for a term does not always render the claim indefinite.** *Energizer Holdings, Inc. v. TTC*, 11 USPQ 2d 1625 (Fed. Cir.2006) quoting *In re Moore*, 169 USPQ 236 (CCPA 1971). A claim containing terms which are seemingly vague is not indefinite if it is **precise when read in the context of the specification.** *Charvat v. Comnr. Pats.*, 182 USPQ 577 (1974).

MPEP states "Where a claim is refused for any reason relating to the merits thereof it should be "rejected" and the ground of rejection fully and clearly stated. See MPEP 707.07(d). Where Applicant traverses an objection, *the Examiner should if he repeats the rejection, take note of Applicants' arguments and answer the substance of it.* see MPEP 707.07(f). *Emphasis added.* It is important for the Examiner to communicate the basis of the rejection so that the issues can be identified early and Applicant can be given fair opportunity to reply. See MPEP 706.02(j). The goal of the examination is to clearly articulate any rejection early in the prosecution process so that the Applicant has the opportunity to provide evidence of a patentability and otherwise reply completely at the earliest opportunity. See MPEP 706.

Appellants submit that the Examiner has not established a *prima facie* case of indefiniteness under 35 U.S.C. § 112 because there is literal support in the specification for the claims. The burden is on the Patent Office to establish *prima facie* case that the indefiniteness requirement has not been met. The Examiner has the initial burden of presenting reasons or evidence supporting his position that the skilled artisan would not recognize the claimed invention in the specification. *Ex parte Sorensen*, 3 USPQ 2nd 1462, 1463 (BPAI 1987) citing *In re Wertheim*, 541 F.2d 257 (CCPA 1976).

From the above, in light of the disclosure of the terms in the specification, it is submitted that the limitations are definite. Appellants request that the Examiner's objections be withdrawn.

35 U.S.C. §103

B. The rejection of the claims under 35 U.S.C. § 103 should be reversed because there are no references in the prior art that taken individually or together disclose all of the elements of the present invention, motivate or suggest the present invention, or provide a reasonable expectation of success.

The claims do not stand or fall together. For purposes of 35 U.S.C. §103, each of Claim 68, Claim 69, Claim 70, Claim 71, Claim 72, Claim 73, Claim 74, and Claim 75 stands apart from each other.

As an initial matter, Appellants arguments are as follows:

- a) The present application has issued as EP1457996 on March 21, 2007. The claims of EP1457996 are similar to the present application. The cited prior by European Examiner were directed to coaxial cables for use in communication or signal cables. The U.S. Examiner cited prior art directed to power or electric cables. The prior art was **not** directed to coaxial cables either. Chan, U.S. 5,486,648, Goehlich, U.S. 6,784,371 and Belli, U.S. U.S. 6,455,769 are all directed to power cables. Power cables are different from communication cables.
- b) The Examiner ignored the limitation of the claims of the present application, for example, “consisting”, “coaxial cable”, “low density polyethylene”, “polyester threads”, “diameter”
- c) Chan, U.S. 5,486,648 taught away from the present invention.
- d) There is no motivation or suggestion to combine Chan with Goehlich and arrive at the present invention.
- e) There is no motivation or suggestion to combine Chan with Goehlich and Belli and arrive at the present invention.

I. The present application has issued as European Patent 1457996 on March 21, 2007. The claims of the issued EP1457996 are the same as the pending claims on appeal.

The present application has issued as European Patent 1457996 on March 21, 2007. The claims of the issued EP1457996 are the same as the pending claims on appeal. Moreover, all of the cited prior art in EP1457996 were directed to **coaxial cables for use in communication cables**.

For example, Murga et al., US2002088641 published on July 11, 2002 is directed to insulating structure for a **coaxial cable** for use as communication cable. It further discloses that the dielectric and mechanical characteristics of the coaxial cables are of great importance in order to assure optimum data transmission and to avoid losses or distortion of data, mainly due to variations of the insulation dielectric characteristics.

Carlson et al., US 6,201,189 issued on March 13, 2001 is directed to **coaxial drop cable** having a mechanically and electronically continuous outer conductor and an associated communications system.

Esker et al., US 5,949,018 issued on September 7, 1999 is directed to Water blocked shielded **coaxial cable**. It further discloses coaxial cables containing a water blocking material to prevent water migration. The most common method of protecting a cable against water penetration is the use of flooding materials to fill the interstices of the cable. Synthetic polymers and petroleum based greases and oils are commonly used as flooding materials.

Pope et al., US 5,796,042 issued on August 18, 1998 is directed to **Coaxial cable** having a composite metallic braid. It further discloses that Coaxial cables having a composite braid with a plurality of water expandable strands of yarn woven therein, preferably to quad coaxial cables having the inner metallic braid as the metallic composite braid.

In contrast to the cited prior art in the issued European patent, the USPTO Examiner cited prior art directed to power cables. None of the cited prior art employed coaxial cables. None of the cables of cited prior art by the USPTO Examiner was used in communication cables.

The cable of Chan is directed to **ground power and electrical cables**. The title of Chan is directed to POWER CABLE. The invention relates to electrical power cables which have concentric neutral wires (CNW). The specification is replete with disclosures directed to power cables. There is no disclosure or suggestion in Chan regarding coaxial cable for use as communication cable.

Goehlich is directed to **power cable**, copper telecom cable or fibre optical cable. The cable has a sensor used for detecting substance inside the cable. There is no disclosure or suggestion in Goehlich regarding coaxial cable for use as communication cable.

The title of Belli is directed to ELECTRICAL CABLES. The invention relates to

electrical cables for medium or high voltage power transmission. The medium voltage refers to voltage between 1kV and 30kV and high voltage refers to more than 30kV. There is no disclosure or suggestion in Belli regarding coaxial cable for use as communication cable.

Appellants submit that all of the cited prior art are directed to **power cables**. None of the above cited prior art was directed to coaxial cables of the present invention. Power cables are long, cylindrical symmetric structures with a dielectric which operates at relatively high electrical stress. See Chan et al., Background of Invention.

The present invention is directed to **coaxial cable** for use as communication cable, e.g., **cable TV** for signal transmission. Coaxial cable is used as a transmission line for radio frequency signals, in applications such as connecting radio transmitters and receivers with their antennas, computer network (Internet) connections, and distributing cable television signals. One advantage of coaxial cables over other types of transmission line is that the electromagnetic field carrying the signal exists only in the space between the inner and outer conductors. This allows coaxial cable runs to be installed next to metal objects such as gutters without the power losses that occur in other transmission lines, and provides protection of the signal from external electromagnetic interference. Coaxial cable differs from other shielded cable used for carrying lower frequency signals such as audio signals, in that the dimensions of the cable are controlled to produce a repeatable and predictable conductor spacing needed to function efficiently as a radio frequency transmission line.

The presently claimed invention is directed to **communication cables**, i.e., **cable TV** networks are designed taking into account the use of coaxial cables for signal transmission from the generation building to the subscribers. Said coaxial cables are classified in trunk, distribution and drop cables, and are usually made up of a core conductor, a dielectric insulation, and external conductor and a protective cover. See Appellants' Field of Invention paragraph 0002. Moreover, the cable can be used for trunk or **distribution cable in transmission networks for radio frequency signals, specifically for analog or digital television transmission signals** as well as energy signals for activating control peripheral equipment. It can also be used for Internet signal transmission, data transmission, cellular phone, etc. See Appellants' Description of Invention paragraph 0016.

Appellants submit that Chan does not disclose "**a coaxial cable**". The Final rejection

stated that Chan discloses a *dry water resistant coaxial cable* (Figs. 1-8). The Board of Appeals opinion dated July 15, 2008 also stated that Chan discloses a “coaxial cable” citing Examiner Answer. It is submitted that nowhere in the patent specification or claims of Chan does “coaxial cable” appears. Appellants submit that there is no disclosure or suggestion of “coaxial cable” in the cited prior art. This is a **mere characterization by the Examiner**.

It is submitted that the present invention is directed to a coaxial cable for use as a signal or communication cable. In contrast, Chan, Belli and Goehlich are directed to **power cables**. It is well known to one of ordinary skill in the art that communication or signal cables are *different and unobvious* over power cables in their properties, characteristics, function, utility and structure.

First, in *power cables*, the current is carried totally by the cross sectional area of the center conductor. The outer conductor is only for protection should the insulation fail. The center conductor carries the power and to make a complete circuit, the power cable needs the center conductor. In contrast, in *communication or signal cables*, the signal is carried by electric and magnetic fields in the dielectric material separating the inner and outer conductor. Signal or communication cable is for transmitting signal. In a signal or communication cable, the center conductor, outer conductor and the dielectric are involved in the signal transmission.

Second, *power cables* are not concerned with **surge impedance or commonly, characteristic impedance**. The characteristic impedance is related to capacitance and inductance per unit length of the cable. In power cables, the dielectric is purely for insulation and to keep the high voltage from collapsing. In contrast, **the characteristic impedance is critical in communication or signal cables**. Characteristic impedance is the effect on signals being transported. The impedance affects the characteristics of the signal or communication cable. If a cable is connected to an ideal pure resistor whose value is equal to its characteristic impedance, a signal transmitted toward the resistor will be entirely absorbed by the resistor and converted to heat. In other words, energy will be reflected up the cable. Otherwise, it generates reflectance characteristic problems and jumbles the signal. Characteristic impedance can be defined along any point on that transmission line as the ratio of a single pair of voltage and current waves at that point in the cable in the absence of all reflections.

Any RF transmission line, of which all coaxial cables and switches are a subset, has some

characteristic impedance that may or may not be constant over the length of that line.

Characteristic impedance can be defined along any point on that transmission line as the ratio of a single pair of voltage and current waves at that point in the cable in the absence of all reflections. The frequency and the per unit resistance, conductance, capacitance, and inductance of a line determines the ratio of voltage and current, and will thus also define characteristic impedance, which is usually denoted Z_0 .

Each type of coaxial cable has a characteristic impedance depending on its dimensions and materials used, which is the ratio of the voltage to the current in the cable. In order to prevent reflections at the destination end of the cable from causing standing waves, any equipment the cable is attached to must present an impedance equal to the characteristic impedance (called 'matching'). Thus the equipment "appears" electrically similar to a continuation of the cable, preventing reflections. Common values of characteristic impedance for coaxial cable are 50 and 75 ohms, as disclosed in the Appellants' specification.

For a coaxial cable, the characteristic impedance is given by the formula:

$$Z_0 = \sqrt{\frac{138}{\epsilon}} \times \log_{10} \frac{D}{d} \text{ in ohms}$$

where "D" is the inner diameter of the outer conductor and "d" is the outer diameter of the inner conductor, respectively. ϵ is the dielectric constant.

As can be observed from this equation, the impedance is a function of the diameters. The conductor diameter can be very accurately controlled, but the dielectric diameter can vary based on the accuracy of the process. If the impedance changes are a consistent spacing of one 1/4 wavelength, this can cause *significant signal loss*.

The cable has to be dry to protect the characteristic impedance, which is important in signal transmission.

Third, *power cables* have not been used for a length of more than 50 miles long, while signal cables are used for 50 miles long for signal transmission. The signal cable, the ratio of diameter of the center and outer conductor determine the characteristic impedance. The breakdown of the dielectric in signal cable is not as important as in the power cable. Nothing in the signal cable is magnetic. However, in power cable, magnetic wires are used so when it is

pulled, it does not break.

Fourth, *power cables* usually have high voltage. In contrast, in a *signal or communication cable*, a single coaxial can provide the power itself. Signal or communication cables have minimum voltage and current. The outer conductor is continuous all the way around so the current can flow in any direction. The dielectric is intact, and carries the information.

In contrast, for power cables, if the dielectric gets wet, power deteriorates and voltage rating.

Power cables have large conductor and large current.

high frequency

Chan, Belli or Goehlich did *not* realize the use of impedance in their *power cables*. In contrast, the characteristic impedance of the *coaxial cable* in the present application $1 \geq f \leq 1000$; f(MHz) is $75.00 \pm 2.0 \Omega$. See Appellants' specification at page 17, line 5. Appellants have discussed in the specification that the dielectric consists of three layers. The first layer, the conductor, is a uniformly thick film made of low density polyethylene mixed with adhesive. Said layer links the conductor to the dielectric and acts as a moisture blocking element and minimizes the presence of air bubbles which contribute to the instability of the characteristic impedance and the structural return losses (SRL).

From the above, Appellants submit that coaxial cables for use in communication cables are different and unobvious from power cables because of their characteristics, properties, structure and utility.

II. The Examiner incorrectly interpreted Claim language

a. Coaxial cables

During patent examination, the patent claims must be "given their *broadest reasonable* interpretation consistent with the specification. *In re Hyatt*, 211 F.3d 1367 , 1372, 54 USPQ2d 1664 (Fed. Cir. 2000). See also MPEP §2111. During patent examination, the pending claims must be interpreted as broadly as their terms reasonably allow. When Applicant states the meaning that the claim terms are intended to have, the claims are examined with that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to prior art. *In re Zletz*, 893 F.2d 319, 321; 13 USPQ 2d 1320, 1322 (Fed. Cir. 1985). See also MPEP §2111.01.

In several aspects of the Examiner's interpretation of the claimed subject matter of the present application, the disclosure in Appellants' specification and the problems in the coaxial cable prior art were *ignored* by the Examiner and defined unilaterally by the Examiner.

For example, the Examiner states in the Office Action dated August 5, 2010, page 5, item 6 as follows:

"Chan discloses a dry, water resistant **coaxial cable** (Fig. 1-8), which provides improved protection against migration of water (Col.1, lines 5-16)..."

It is submitted that there is no disclosure or suggestion in Chan regarding **coaxial cables** for use in communication cables. Upon Appellants' review of Col. 1, lines 5-16 of Chan, US 5,486,648, the specification of Chan in fact discloses as follows:

"This invention relates to **electrical power cables** which have concentric neutral wires (CN wires) applied helically over the cable... More particularly, the invention relates to improved protection against migration of water in **such power cables**.....

Next, the Examiner states, at page 16 of the Office action dated August 5, 2010, last paragraph as follows:

"...Clearly, Belli also teaches a **power cable** having an external conductor (i.e. external shield layer) in the form of metallic foil layer, wherein overall purpose is to provide cable with protection from migration of water...."

As such, Appellants submit that the Examiner has *not* correctly and clearly interpreted the claims and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 321; 13 USPQ 2d 1320, 1322 (Fed. Cir. 1985). See also MPEP §2111.01.

It is submitted that all of the cited prior art by the Examiner do not disclose or suggest **coaxial cables** for use as communication cables as claimed in the present invention.

b) TRANSITIONAL PHRASE "CONSISTING OF"

It is submitted that the Examiner incorrectly interpreted the claim language of the presently claimed invention by ignoring the fact that Appellants have amended the transitional phrase of Claim 68 to "*closed-ended*" language, "consisting of." The Examiner failed to consider all of the claim limitations in the Appellants' dry water resistant coaxial cable. It is submitted that these limitations are an objective indicia of **non-obviousness**.

MPEP §2111.03 provides that transitional phrase “consisting of” excludes any element, step, or ingredient *not* specified in the claim. *In re Gray*, 53 F.2d 520, 11 USPQ 255 (CCPA 1931); *Ex parte Davis*, 80 USPQ 448, 450 (Bd. App. 1948) (“consisting of” defined as “closing the claim to the inclusion of materials other than those recited except for impurities ordinarily associated therewith.”).

The claims are explicitly limited in that no other component can be included in the coaxial cable. “Consisting of” is a term of patent convention meaning the claimed invention contains only what is expressly set forth in the claim. *Vehicular Techs Corp. v. Titan Wheel Int’l. Inc.*, 212 F.3d 1377, 1382-83 (Fed. Cir. 2000). “Consisting of” as used in the claims of the presently claimed invention limits the coaxial cable to claimed elements.

Broad claim 68 recites a dry, water resistant coaxial cable “**consisting of**”: a metal core conductor element, a dielectric element around the core conductor based on three layers,

the *first layer* being applied onto the conductor as a uniformly thick film based on low density polyethylene mixed with a vinyl or acrylic *adhesive*,

the *second layer* being based on an expanded polyethylene mix consisting of low density polyethylene or mixture of low, medium and high density polyethylenes and a *swelling agent* selected from azodicarbonamide, p-toluene sulphonylhydrazide, or 5-phenyltetrazol, and

optionally a *reinforcement layer* of the same characteristics as the first layer; wherein it has a second external conductor element formed by a tape made of an aluminum or copper alloy or combined with other elements and surrounding said conductor **consisting of** a water penetration protective element keeping it dry and based on one or several swellable fibers or tapes formed by polyester threads or other swellable fibers; and the protective cover based on low, medium, high density polyethylene or a combination thereof.

Applying the above case laws to the present invention, it is submitted that the presently claimed invention is narrowed and limits the scope of the claims due to the transitional phrase “consisting of.” It is submitted that the phrase “consisting of” *narrows* the scope of the presently claimed invention. The claims directed to dry coaxial cable and manufacturing method thereof are narrowed to the recited elements or embodiments (or steps) and nothing more.

Appellants submit that the introduction of other components or additional steps would materially change the characteristics or properties of the presently claimed invention. *In re De Lajarte*, 337 F.2d 870, 143 USPQ 256 (CCPA 1964). See also *Ex parte Hoffman*, 12 USPQ2d

1061,1063-64 (BPAI 1989).

In contrast, the term “comprising” is “open ended” or inclusive. In effect, comprising is a shorthand way of saying “including the following elements but not excluding others.” For example, a claim to a combination comprising A + B covers a combination having A + B + C. The term “consisting of” is a closed term. Thus, a combination consisting of A + B does not cover the combination A + B + C. **A closed language excludes more than traces of other ingredients.**

Appellants have compared and identified the elements that are required in the presently claimed invention and the cited prior art.

The cited prior art Goehlich (U.S. 6,784,371) and Belli (U.S. 6,455,769) used transitional phrase “comprising” which are open ended and inclusive.

Similarly, Chan et al. (U.S. 5,486,648) employs the transitional phrase “*having*.” Case laws have interpreted the term “having” as “open terminology, “allowing the inclusion of other components in addition to those recited;” *Crystal Semiconductor Corp. v. TriTech Microelectronics Int'l Inc.*, 246 F.3d 1336,1348, 57 USPQ2d 1953,1959 (Fed. Cir. 2001). Transitional phrases such as “having” must be interpreted in light of the specification to determine whether open or closed claim language is intended. See, e.g., *Lampi Corp. V.American Power Products Inc.*, 228 F.3d 1365, 1376, 56 USPQ2d 1445, 1453 (Fed. Cir. 2000). In light of the specification, it is submitted that Chan et al. intended the claims and disclosure to be open ended or inclusive, i.e., different variations, combinations and embodiments were intended.

Broad claim 1 of Chan et al. recite a cable “having” concentric neutral wires (CN) wires applied over a cable construction extending in a longitudinal direction to provide a metallic ground shield and having protective polymeric jacket over said concentric neutral wires characterized in that at least one continuous elongated water swellable element.

Appellants object to **Examiner’s interpretation of Claim 68** on page 5 of the Office Action, stating, “[C]han discloses a dry, water resistant **coaxial cable** (Figs. 1-8)...with respect to claim 68, Chan discloses a cable (Fig.3) consisting of a metal core conductor element (1), a dielectric element (2-4) around conductor core (1) which is based on three layers, consisting of a first layer (2) being applied to the conductor (1) as an uniform layer (Col.5, lines 17-26 and being a material such as XLPE (i.e. low density polyethylene, col. 4, lines 19-25), a second layer (3) comprising cellular expansion polymer (i.e. XLPE) on first layer (2, Col. 5, lines 15-25) wherein cellular expansion polymer is a low dielectric coefficient polymer (i.e. XLPE), col. 5, lines 15-25) and a third layer (4) comprising a reinforcement layer on the second layer (3, Col.

15-25) wherein first layer and third layer (2 & 4) may comprise a material such as (i.e. XLPE), low density polyethylene, Col. 4, lines 19-25) which have same characteristics (i.e. the first and third layer may be the same material XLPE), a second conductor (6) surrounding the dielectric element (4) consisting of a water penetration protective element (i.e. swellable tape, Col.6, lines 1-7) capable of keeping the cable dry (Col. 1, lines 5-16) wherein water penetration protective element (5d) may comprise plurality of swellable fibers (5 & 5d as shown in Fig 8) made of polyester fibers (Col. 3, lines 64-67) and a protective cover (7) made of low, medium or high density polyethylene (Col. 5, lines 37-40).”

There is no disclosure or suggestion regarding the transitional phrase “consisting of” in Chan. Similarly, this is another *mere characterization* by the Examiner.

Moreover, Chan discloses concentric neutral wires (CNW) which are non-continuous as discussed below. This element was not disclosed or suggested in the coaxial cable for use in communication cable of the present invention.

The claim of Belli (U.S. 6,455,769) recited an electrical cable “**comprising**”: conductor (1); at least one insulating layer (3); outer metal shield (6) and a layer of expanded polymer material (5) placed under metal shield; characterized in that the layer of expanded polymer material is semiconductive and includes water swellable material wherein the expanded layer material has a degree of expansion between 5% and 500%.

Belli’s Claim 2 recited a cable according to claim 1 wherein expanded layer has a **predetermined degree of expansion**.

The broad claim of Goehlich (U.S. 6,784,371) recited a cable “**comprising**” a cable core (1); an inner cable sheath (2); outer cable sheath (3); sensor (4) and a structured material between inner cable sheath and outer sheath arranged to allow any detectable substance entering between the inner cable sheath and outer cable sheath travel along the perimeter of inner cable sheath to reach sensor.

From the above, it is submitted that the Cha, Goehlich and Belli include other elements or structure which are not required in the components or elements in coaxial cable for use in communication cable of the present invention. It is submitted that the arrangement of the elements, the different layers, the specific element, the properties of the element, the utility and the field of endeavor by the coaxial cable for use in communication cable of the present invention are different and unobvious over the cited prior art.

The Examiner ignored the claim limitation “consisting of”. As such, Appellants submit that the Examiner has *not* correctly and clearly interpreted the claims and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 321; 13 USPQ 2d 1320, 1322 (Fed. Cir. 1985). See also MPEP §2111.01.

c) **XLPE or CROSS LINKED POLYETHYLENE is not equivalent to low density polyethylene.**

For the semi-conductor shield layer (2) of Chan required polymeric compounds such as crosslinked polvolefin (XLPE),¹ ethylene propylene **rubber** (EPR) or ethylene vinyl acetate (EVA). Note col. 4, line 26 of Chan. In contrast, the *structure* of Appellants’ cable required low density polyethylene (LDPE)² These materials are different in function and properties. It is submitted that crosslinked polyolefin (XLPE), EPR or EVA of Chan are not functionally equivalent to LDPE of the presently claimed invention.

As discussed in the Appellants’ brief, XLPE or “cross-linked” polyethylene is **not equivalent** to low density polyethylene (LDPE) because they have different properties. XLPE is **crosslinked or cured**. See attached information on Cross-linked Polyethylene.

The Examiner alleged that XLPE and LDPE have the same density. Appellants submit that although the XLPE and LDPE may have the same density, they have great differences in electrical and thermal properties. The crosslinked polyethylene (XLPE) as disclosed in the prior art **required a cured process in order to obtain its heat resistance** and thus, have **high dielectric constant**. It is well known in the art that the dielectric constant is an **essential** piece of information when designing capacitors and in other circumstances where a material might be

¹ XLPE a medium- to high-density polyethylene containing cross-link bonds introduced into the polymer structure, changing the thermoplastic into an elastomer. The high-temperature properties of the polymer are improved, its flow is reduced and its chemical resistance is enhanced. In polymer chemistry, when a synthetic polymer is said to be “crosslinked”, it usually means that the entire bulk of the polymer has been exposed to the crosslinking method. See www.wikipedia.org/wiki/XLPE.

² LDPE is defined by a density range of 0.910-0.940 g/cm³ LDPE has a high degree of short and long chain branching, which means that the chains do not pack into the crystal structure as well. It has, therefore, less strong intermolecular forces as the instantaneous-dipole induced-dipole attraction is less. This results in a lower tensile strength and increased ductility. LDPE is created by free radical polymerization. The high degree of branching with long chains gives molten LDPE unique and desirable flow properties. See www.wikipedia.org/wiki/LDPE

expected to introduce capacitance into a circuit. If a material with a **high dielectric constant** is placed in an electric field, the magnitude of that field will be measurably **reduced** within the volume of the dielectric.

In contrast, the low density polyethylene (LDPE) employed in the present invention has **no** thermal extended properties because they are **not cross linked** and **has a low dielectric constant** which provides **low capacitance for transmission properties**. It is submitted that XLPE is not equivalent to LDPE in their properties. XLPE can not be employed as insulation in a cable of the present invention that requires low capacitance.

| | Thermal Properties | Electrical Properties | Use | Curing Process | Crosslinked |
|------|---|--|---|----------------|-------------|
| XLPE | Curing process requires heat resistance | High dielectric constant | Chan uses XLPE for power cable | Yes | Yes |
| LDPE | No thermal extended properties | Low dielectric constant; Provides low capacitance for transmission properties | The present invention uses LDPE for communication or signal cable | No | No |

It is submitted that low dielectric properties are important in a signal or communication cable because of the high frequency. It is well known in the art that in a signal cable, the energy is in the form of electric and magnetic properties. For power cable, the dielectric characteristics are different from a communication cable as claimed in the present invention. The dielectric properties are less critical and can withstand DC voltage.

The Examiner argued that it is known in the art that polyethylenes have a density of between 0.91 and 0.94 are considered to be low density polyethylene and that XLPE has a density of 0.93 g/cc. Appellants submit that XLPE material employed in Chan may have the same density but they have great differences in electrical and thermal properties. The XLPE polyethylene requires a cured process to obtain its heat resistant and the dielectric constant is also high. The low density polyethylene (LDPE) employed in the present invention has no thermal extended properties because they are not cross linked and their dielectric constant are

low to provide low capacitance for transmission properties. The XLPE is not used as insulation in coaxial cables because it requires low capacitance.

Coaxial cable has a property known as *characteristic impedance* which is related to capacitance and inductance per unit length of the cable. The characteristic impedance is most easily thought of in terms of the effect on signals being transported. If a cable is connected to an ideal pure resistor whose value is equal to its characteristic impedance, a signal transmitted toward the resistor will be entirely absorbed by the resistor and converted to heat. In other words, no energy will be reflected on the cable. The characteristic impedance Z_0 (in ohms) is a function of the relative diameters of the center of the conductor and inner surface of the outer conductor and of the dielectric constant of the dielectric.

The Examiner stated at page 20 of OA that LDPE was employed in the present invention and XLPE was employed in Chan et al. However, MPEP 2111 states that during patent examination, pending claims must be given their *broadest reasonable* interpretation, consistent with the specification. Thus, according to the Examiner's interpretation, XLPE in the cited prior art included LDPE of the coaxial cable for use in communication cable of the present invention.

Appellants specification is directed to "coaxial cable for use in communication or signal cable for transmitting RF signals, cable data signals, cellular telephone signals, internet or data signals without the use of fillers." This disclosure is consistent with the specification. Moreover, as discussed below, the Court held that the Office must always construe claims "in light of the specification and the teachings of the underlying patent." Here, both the "express language of the claim and the specification" mitigated against the Office's construction, and "require the use of LDPE as the layer in the presently claimed coaxial cable" See *In Re Suitco Surface Inc.* (No. 2009-1418) decided April 14, 2010.

As such, Appellants submit that the Examiner has *not* correctly and clearly interpreted the claims and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 321; 13 USPQ 2d 1320, 1322 (Fed. Cir. 1985). See also MPEP §2111.01. The Examiner incorrectly interpreted the claim language of the coaxial cable for use in communication cable of the present invention.

d) The polysaccharides or polyacrylic are **not functionally equivalent** to the polyester material of the presently claimed invention.

The Examiner ignored the limitation of the Appellants' coaxial cable by interpreting starch graft copolymer of polyacrylic acid, and carboxy methylcellulose as functionally equivalent to polyester material. Chan required the use of water swellable element WSE (5) such as yarn, filament, strand or strip in combination with swelling agent such as polyacrylamide, starch graft copolymer of polyacrylic acid, and carboxy methylcellulose. Chan required that WSE (5) is in *contact* with the "plurality of" CN wires in order to block the passage of water within the cable in the longitudinal direction. The WSE employed are starch graft copolymer of polyacrylic acid or carboxymethylcellulose.³ The functional group in polyacrylic is **acyl group** while in polyester, the functional group is an **ester group**. In addition, starch and carboxymethylcellulose are classified as polysaccharides. Thus, besides being classified as polysaccharides, having different functional group and different form, i.e., yarn, filament, strip or strand from polyester tapes or fibers of the presently claimed invention. It is submitted that carboxymethyl cellulose (CMC) is a cellulose derivative with carboxymethyl groups bound to some of the hydroxyl groups of the glucopyranose monomers that make up the cellulose backbone. The polysaccharides or polyacrylic are **not functionally equivalent** to the polyester material of the presently claimed invention.

The Examiner proposes that Chan et al.'s polysaccharide copolymers in the form of yarn, filament, strip or strand and in contact with the "plurality of" CN wires can be employed and achieve the dry, water resistant cable of the presently claimed invention.

Appellants disagree. It is submitted that it is highly unlikely that one of ordinary skill in the art would substitute a polyester fiber or tape for the polysaccharide filament, strips or yarn of Chan et al.'s power cable.

Thus, Chan taught away from the present invention because the Appellants' cable required the use of polyester fibers or tapes for water protection element (16). Chan employs starch graft copolymer of polyacrylic acid, carboxymethylcellulose yarns, filament or strip in order to maintain contact with insulation shield. Note col. 3, lines 56-63.

Moreover, Chan taught away from the presently claimed invention because it avoids the use of tapes for its water swellable elements. For example, Chan discloses at col. 2, lines 21-26

³ Starch and carboxymethylcellulose are classified as "polysaccharide" and are linked through glycosidic linkages. The functional group of polyacrylic acid is an acyl group while in polyester, the functional group is an ester group. These functional groups and classification are not equivalent.

as follows:

The use of a layer of water swellable tape over the length of the cable increases the overall diameter and weight of the cable which in many instances, is **undesirable**. Also the **cost associated with the application of water swellable tape and powder is significant and will translate into a higher cost of the cable**.

Further, Chan discloses at col. 3, lines 55-64 as follows:

“...The water swellable element, such as **yarn, filament strand or strip** may be non-conductive or semi-conductive. The reason for which it can be non-conductive is that CN wires will still maintain a substantial (over 90%) contact with semi-conductive insulation shield of the cable core on which the CN wires are applied. ***This is different from the use of tape*** covering entire cable core and which must be semi-conductive to maintain such electrical contact....”

In addition, Chan further discloses at col. 6, lines 14-17 as follows:

“...Moreover, the arrangement according to the invention **provides an improved construction in relation to the one that would use only tapes** over the entire length of the cable...”

From the above, Appellants submit that Chan taught away from the use of water swellable tapes of the presently claimed invention because Chan uses water swellable yarns or fibers.

Finally, because of the transitional phrase “comprising” in Chan, the claims allow WSE in various configuration and embodiments with “plurality of”CN wires and cable. For example, a) WSE can be helically wound around the core construction under “plurality of”CN wires with a lay opposite that of “plurality of”CN wires. See Fig. 1 (best longitudinal effectiveness) Note col. 3, lines 5-9; b) WSE may be helically wound over the “plurality of”CN wires with a lay opposite that of “plurality of”CN wires. See Fig. 3; c) WSE can be helically wound under and over the “plurality of”CN wires with a lay opposite that of “plurality of”CN wires. See Fig. 4; d) WSE can be helically wound under the “plurality of”CN wires with a direction opposite and the same as that of “plurality of”CN wires. See Fig.5; e) WSE can be helically wound around each CN wires. See Fig. 6; f) WSE can be helically wound around the core of cable under the “plurality of”CN wires in opposite direction to that of CN wires and other yarns wound around each CN wires. See Fig.7; g) WSE may be applied over the “plurality of”CN wires and at least one wound around cable and under “plurality of” CN wires. See Fig.8. These various

embodiments are not included in the coaxial cable for use in communication cable of the present invention.

In summary, it is submitted that these embodiments are not encompassed by the presently claimed invention. It is submitted that the coaxial cable, communication cable, the transitional phrase “consisting of”, the arrangement of the elements of the cable in a particular sequence, the use of polyester, the properties, configuration and manner of layering of the components of the cable of the presently claimed invention are totally different from that of the power cable of Chan et al. It is submitted that the use of a “plurality of” CN wires was not encompassed by the presently claimed invention. It is submitted that the XLPE is not functionally equivalent to LDPE. Moreover, as discussed above, WSE yarns listed in Chan is not functionally equivalent to the polyester tapes of the presently claimed invention.

As such, Appellants submit that the Examiner has *not* correctly and clearly interpreted the claims and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 321; 13 USPQ 2d 1320, 1322 (Fed. Cir. 1985). See also MPEP §2111.01.

e) Specific parameters of the Coaxial Cable of the present invention

The Examiner alleged that with respect to Claim 71, Belli teaches the diameter of the insulation layer may be 14 mm. Col.9, line 54. See OA dated May 19, 2009 at page 9, lines 3-4. Upon reading Belli at col. 9, line 54, it discloses as follows:

Example 5

A medium voltage cable was produced using polymer composition of Example 4, according to the structure reported in Figure 1.

The cable core consisted of an aluminum conductor having a 150 mm² cross section and a 14.0 mm diameter, coated with the following layers, **crosslinked** with peroxide on a catenary line:

An inner semiconductive layer; product LE 0595 from Borealis (0.6 mm thick)

An insulating layer made of **XLPE** (4.65 mm thick).

The expanded layer was deposited on this core (having an outside diameter of about 25.3 mm by extrusion according to technique described in Example 3.

First, it is submitted that the diameter data that was listed in Belli refers to aluminum conductor. The diameter is 14.0 mm. The semiconductive layer (4) is 0.6 mm; The insulating layer (3) is 4.65 mm. The expanded layer is 25.3 mm. In contrast, in the presently claimed invention, the copper plated aluminum wire has a uniform circular cross section of 3.15± 0.03 mm diameter.

It is submitted that the total diameter of the conductor of the coaxial cable for use in communication cable of the present invention is different and unobvious over the diameter of the conductor disclosed in Belli

Second, it is submitted that the base material in Example 3 is a **thermoplastic elastomer**. Moreover, the insulating layer is XLPE, (LE 0595 from Borealis is XLPE). The 2nd layer in the presently claimed invention is either low, medium or high density polyethylene. As discussed above, thermoplastic elastomer is not functionally equivalent to LDPE of the presently claimed invention.

Third, the 2nd layer, the polyethylene mix is in combination with the swelling agents selected from azodicarbodiimide, p-toluene sulphonylhydrazide or 5-phenyltetrazol when applied onto the core conductor in accordance with Claim 71 offers a 13.0 ± 0.10 mm diameter. In contrast, it is submitted that Belli et al. discloses the aluminum conductor (6) by itself as having a 14.0 diameter. This is "totally different" from the expanded layer (5) of Belli.

Fourth, The Examiner alleged that with respect to Claim 72, Belli teaches that the outer conductor may be a material formed as a cylinder pipe (i.e., metallic tube) which can be longitudinally welded or edges overlapped. Col. 4, lines 55-60; wherein shield (6) may have an external conductor thickness of at least 0.2 mm and a diameter of 14.2 mm (Col. 10, lines 12-15). Note page 9, lines 4-6 of OA dated May 19, 2009.

Belli discloses at col. 4, lines 55-60 as follows:

The conductor (1) generally consists of metal wires preferably copper or aluminum, which are braided together using conventional techniques.
The metal shield (6) usually made of aluminum or copper or also lead, consists of *continuous metal tube or of a metal sheet shaped into a tube* and welded and sealed using an adhesive material so as to make it watertight.

From the above, it is submitted that there is no disclosure or suggestion in Belli regarding the use of an external conductor formed by a tape made of aluminum or copper alloy welded with edges overlapped with a thickness of 0.34 mm and diameter on the pipe is 13.7 ± 0.10 mm. There is no suggestion to one of ordinary skill in the art regarding the external conductor made of a tape of aluminum or copper alloy claimed in the coaxial cable for use in communication cable of the present invention in Belli et al.

Furthermore, Belli discloses at col. 10, lines 12-15 as follows:

The so obtained cable was then wrapped with a lacquered aluminum stip [sic] (thickness 0.2 mm) using an adhesive to bond the overlapping edges. Eventually, an external sheath made of *PVC* was applied by extrusion.

It is submitted that Belli discloses a cable wrapped with lacquered aluminum which employs an adhesive. In contrast, the adhesive employed in the presently claimed invention was with the 1st layer polyethylene combination. There's no motivation or suggestion to one of ordinary skill in the cited prior art directed to power cables to achieve the coaxial cable for use in communication cable.

Moreover, there is no motivation to "pick and choose" from an infinite number of "expanded layer" disclosed in Belli et al. *In re Albrecht*, supra

Finally, the cable elements of Belli are open ended and required "expanded layer" to have **predetermined degree of expansion of between 5% and 500%** which was not encompassed by Appellant's coaxial cable. The *only* teaching linking (nexus) the structure of Chan, Goehlich and Belli is found in the presently claimed invention. Moreover, even if the references did indicate that such modification might be tried, an *obvious-to-try* standard would be indicated, which is clearly *not* a sufficient basis for the rejection. It is submitted that the specified claimed modifications must be specifically motivated or suggested by the prior art.

MPEP 2143.03 entitled "All Claim Limitations must be Considered" states: "all words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)."

It is submitted that the Examiner ignored the above claim limitations in determining *prima facie* case of obviousness

To establish *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in references or knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references (or references when combined) must teach or suggest all the claim limitation. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must be found in the prior art and not based on Applicants' disclosure. *In re Vaeck*, 947 F.2d 488; 20 USPQ 1438 (Fed. Cir. 1991).

Appellants submit that the elements of a *prima facie* case of obviousness have not been

met, since the teachings of Chan reference, as modified by the Examiner with the teachings of Goehlich or Belli reference fail to teach or suggest all of the claim limitations. All of the cited prior art were directed to power cables. None of the cited prior art disclose or suggest coaxial cables the use in communication cable of the present invention..

Chief Judge Rader, writing an opinion joined by Judges Prost and Moore noted that although the USPTO is to give claims their **broadest reasonable construction**, “[t]he broadest-construction rubric coupled with the term ‘comprising’ does not give the USPTO an *unfettered license to interpret claims to embrace anything remotely related to the claimed invention. Rather, claims should always be read in light of the specification and teachings in the underlying patent.*” Here, the Board’s construction was contrary to the express language of the claim and the specification which disclosed a clear plastic material that is to be the final treatment or coating of a surface and not some intermediate layer. The court concluded that the Board’s construction was unreasonable in light of the claim and specification and remanded the case back to the USPTO for a new validity analysis using the appropriate standard.

The Federal Circuit, in an opinion by Judge Rader joined by Judges Prost and Moore, vacated and remanded the Office's grounds of rejection based, in part, on the unreasonable construction of claim terms that expanded their scope to encompass the prior art.

The problem, according to the Court, is that the Office has *ignored* the part of the standard that limits the bounds of what is "**reasonable**" to what is consistent with the specification: the rubric is not merely that claims must be given "their broadest reasonable construction" but that they be given "their broadest reasonable construction consistent with the specification" (emphasis added). Moreover, claims are to be read "in light of the specification as it would be interpreted by one of ordinary skill in the art," citing *In re Bond*, 910 F.2d 831, 833 (Fed. Cir. 1990).

The opinion particularly rejects the Office's reliance upon and justification of its construction because the patentee used the term "comprising" in the claim. "The broadest-construction rubric coupled with the term 'comprising' does not give the PTO an unfettered license to interpret claims to embrace anything remotely related to the claimed invention," according to the opinion. Citing *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 217 (1940) (perhaps on the panel's mind after its extensive citation in the *en banc Ariad v. Eli Lilly*

appeal), the Court held that the Office must always construe claims "in light of the specification and the teachings of the underlying patent." Here, both the "express language of the claim and the specification" mitigated against the Office's construction, and "require the finishing material to be the top and final layer on the surface being finished." In *In Re Suitco Surface Inc.* (No. 2009-1418) decided April 14, 2010.

From the above, the Examiner incorrectly ignored the claim limitations of the presently claimed coaxial cable for use in communication cable. The Examiner has failed to show *prima facie* case of obviousness using the cited prior art references.

DISCUSSION

Claim 68 is the only independent claim and reads as follows:

Dry, water resistant coaxial cable **consisting** of :

a metal core conductor element, a dielectric element around the core conductor based on three layers,

the *first layer* being applied onto the conductor as a uniformly thick film based on low density polyethylene mixed with a *vinyl or acrylic adhesive*,

the *second layer* being based on an expanded polyethylene mix **consisting** of low density polyethylene or mixture of low, medium and high density polyethylenes and a swelling agent selected from azodicarbonamide, p-toluene sulphonylhydrazide, or 5-phenyltetrazol, and

optionally a *reinforcement layer* of the same characteristics as the first layer; wherein it has a *second external conductor* element formed by a tape made of an aluminum or copper alloy or combined with other elements and surrounding said conductor **consisting** of a water penetration protective element keeping it dry and based on one or several swellable *fibers or tapes* formed by polyester threads or other swellable fibers; and

the *protective cover* based on low, medium, high density polyethylene or a combination thereof.

The present application discloses a dry, water resistant coaxial cable, the embodiment of which are illustrated in the Figure below.

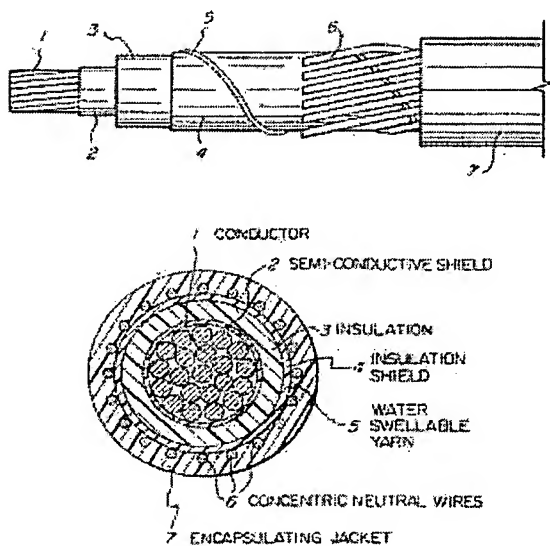
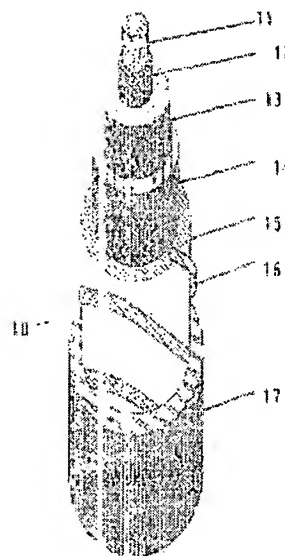


FIG. 1



- 11 Core
- 12 Low density polyethylene + adhesive
- 13 Low density Polyethylene + swelling agent
- 14 Low density polyethylene + adhesive
- 15 Aluminum or copper alloy tape
- 16 Swellable fibers or tapes made of Polyester threads
- 17 Low, medium or high density polyethylene

Chan, US Patent 5,486,648
Power Cable

**Coaxial Cable of the present invention
for use as Communication cable**

As discussed above, the claims have been amended to “consisting of” which **excludes** several limitations disclosed in the cited prior art. Appellants submit that the use, structure, design, diameter, material, cable configuration, order of position and layering of the respective components and physical and chemical properties of elements of the presently claimed dry, water resistant **coaxial cable** are different and unobvious over the cited prior art. For example, the use of low, medium, or high density polyethylene (LDPE, MDPE, HDPE); specific adhesives, swelling agents; the coating and layering of the area around the thin sleeve and the core of stranded conductors; the deposit of the swelling material in a quantity that is proportional to the required thickness of the said film are required to achieve the dry, water resistant coaxial cable for use as communication or signal cable.

Appellants submit that Chan, U.S. 5,486,648 taught away from the presently claimed invention. Appellants submit that all the cited prior art is not analogous to the field of endeavor of coaxial cable for use as communication cables.

Chan et al. (U.S. 5486648)

First, the key requirement of Chan et al. which is directed to **power cables** is the

presence of a “plurality of” of concentric neutral wires (CN) in its cable to prevent water penetration. Note col. 1, lines 5-15; lines 55-58. The disclosure of Chan made it clear that “plurality of” CN wires (6) was an essential element and properties of the cable would be materially and significantly affected if the “plurality of” CN wires were modified or deleted.

Second, the Examiner alleged that the concentric neutral wires (CNW) (6) is *equivalent* to the external conductor (15) of the presently claimed cable. Appellants disagree. It is submitted that in Chan et al., as shown in the Figure above, the concentric neutral wires (CNW) are **not solid, i.e., not continuous** (See Figures 1-8 of Chan). In contrast, the external conductor of the present invention is **continuous** and **solid all the way around**. The external conductor supports the electric field. This property **can not** be performed by the CNW of Chan because the wires **are stranded or not connected**. It is submitted that a non-continuous path will not provide the magnetic and electric path. It has to be a continuous conductor. The current will not flow because the conductors are separate. The CNW will not work in a communication or signal application as claimed in the present application.

The external conductor of the present invention has different *functions*. First, it provides to the coaxial cable a second conductor; Second, the second conductor is a shield against electromagnetic fields because it completely encloses the inner conductor; and Third, the second conductor is completely hermetical (airtight) and provides protection against humidity. It is submitted that the CNW of Chan et al. does not provide any of these functions.

Finally, the outer shield has to be a good conductor to maintain the magnetic and electric field. If CNW was employed in the presently claimed invention, the impedance (ratio of the voltage to current in the cable) will be low, i.e., the CNW will impede the flow of current.

A person of ordinary skill in the communication cable art (POSA) familiar with the problems of water penetration in coaxial cables would understand that “plurality of” CN wires are not equivalent to or could not be incorporated or substituted for the external conductor (15) of the present invention because CNW (6)

Moreover, the transitional phrase “consisting of” did not allow for the presence of “plurality of” CN wires. The “comprising” language in Chan provided “plurality of” CN wires and other elements in different variations and embodiments in combination with the water swellable elements, the combinations of which were not allowed in Appellants’ cable.

In this regard, the Examiner *ignored* the transitional phrase “consisting of.” The scope of the claims is *limited* to the designated elements, configuration or material of the presently

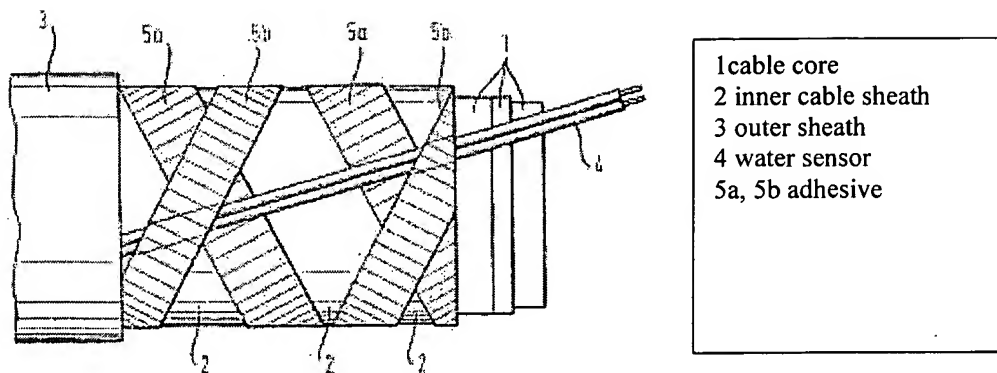
claimed dry, water resistant coaxial cable, as well as the order of the position of each of the elements as recited and nothing more.

Next, as discussed above, the semi-conductor shield layer (2) of Chan required polymeric compounds such as **crosslinked polyolefin** (XLPE), ethylene propylene **rubber** (EPR) or ethylene vinyl acetate (EVA). Note col. 4, line 26 of Chan. In contrast, the structure of Appellants' cable required low density polyethylene (LDPE). These materials are different in function and properties. It is submitted that crosslinked polyolefin (XLPE), EPR or EVA of Chan are not functionally equivalent to LDPE of the presently claimed invention. Moreover, it is submitted that the use of XLPE of Chan which is thermoplastic rubber is fundamentally different and cannot be substituted for LDPE and achieve the resulting product of the present invention. Similarly, the properties of the dry, water resistant cable of the presently claimed invention would not be significantly affected if XLPE, EVA or EPR were not employed, whereas the properties of Chan et al. would be materially affected.

Finally, as discussed above, the water swellable element (WSE) material employed in Chan in the form of yarn, filament, strand or strip and in combination with swelling agent such as polyacrylamide, starch graft copolymer of polyacrylic acid and carboxymethylcellulose. Starch and carboxymethylcellulose are polysaccharide. Chan required WSE in contact with CNW (6) which are not continuous. Chan avoids the use of tapes for its water swellable material as discussed above. In contrast, the external conductor of the present invention is continuous and the water swellable element in the form of tapes employed is polyester material. It is submitted that polysaccharides or polyacrylic are not functionally equivalent to polyester material of the present invention. Thus, Chan *teaches away* from the present invention.

Appellants submit that there is no motivation or suggestion to combine Chan with Goehlich and arrive at the present invention.

FIG. 1



Goehlich Power cable

Goehlich (U.S. 6,784,371)

First. Goehlich is directed to power cables “comprising” a cable core, inner cable sheath, an outer sheath and a sensor. The cable of Goehlich is *continuous*. The cable of Chan is *not continuous* because of the CNW (6). There is not motivation or suggestion to one of ordinary skill in the art to combine a *continuous* power cable with a *non-continuous* power cable and arrive at the coaxial cable for use as communication cable of the present invention.

The claims of Goehlich are open ended. The configuration and properties of Goehlich’s cable are totally different from the configuration and properties of the Appellants’ dry water resistant coaxial cable. Goehlich required a sensor for detecting a detectable substance inside the cable. In contrast, the Appellants’ cable does not require a sensor. The object of the Appellants’ present invention is to improve dielectric surface appearance and permit better control of the dielectric swelling process.

Second. Goehlich required a “structured material” (SM) between the inner cable sheath and the outer sheath. Moreover, the disclosed “**structured material**” of Goehlich is from an **infinite list** of swellable material; self adhesive; tape combination; sputtered tape; stripe shaped tape; or sealing material, etc. Note cols. 4-6. However, of this **infinite list**, Goehlich examples or preferred embodiments demonstrate the use of either “self adhesive” or “one strip shaped sputtered adhesives”, *alone or by itself*. There is no guidance in Goehlich on which “structured material” should be selected by one of ordinary skill in the art with a reasonable expectation that it would work efficiently as the coaxial cable for use in communication cable of the present invention..

In contrast, the cable of the presently claimed invention employs a first layer (12) of low density polyethylene in combination or mixed with vinyl or acrylic adhesive. This property of polyethylene adhesive combination is an important and unobvious difference from the Goehlich disclosure.

The Examiner alleged that it would be obvious to use the adhesive of Goehlich in the cable of Chan et al. and arrive at the presently claimed invention. The present invention involved a chemical mixing of polyethylene and adhesive. It is submitted that it is not a matter of applying a film of adhesive on a plastic sheath as employed in Goehlich which is a *physical change*.

It is submitted that the 1st or 3rd layer of the presently claimed invention is made of polyethylene, wherein the film is thin, continuous and homogeneous; and the material is mixed with an adhesive selected from a group consisting of vinyl adhesive or acrylic adhesive. The film has low dielectric coefficient in order to have maximum signal propagation and minimum attenuation. The polymer has to be *thin* as possible to maintain transmission characteristics but its application onto the core conductor has to be *continuous and homogeneous* because otherwise electric problems will occur such as cable signal reflection. The main function of these layers is to protect core conductor against corrosion and control adherence between the core and dielectric.

Where the prior art does not show a reason or motivation to make the necessary changes in the prior art compound to achieve the claimed compound, a *prima facie* case of obviousness will generally fail. *Yamanouchi Pharmaceutical Co. v. Danbury Pharmacal, Inc.*, 231 F.3d 1339 (Fed. Cir. 2000).

It is submitted that there is no motivation or suggestion to one of ordinary skill in the art to *modify* the power cable of Chan which employs “a plurality of” CN wires which is not continuous, XLPE, a thermoplastic elastomer and mixed with an adhesive from the infinite list of “structured material” listed in Goehlich, directed to a power cable. There is no guidance to one of ordinary skill in the art on how to pick and choose which “structured material” would be suitable for use with XLPE, thermoplastic elastomer of Chan et al. There is no suggestion to one of ordinary skill in the art that there is a reasonable expectation that the presently claimed invention would be achieved. More particularly, the properties of presently claimed invention would not changed even if the cable excludes “a plurality of” CN wires of Chan et al. or sensor of

Goehlich. Moreover, the presently claimed invention employs LDPE (polyethylene) mixed with vinyl or acrylic adhesive and *nothing more*. Chan encompasses several broad embodiments of “plurality of” CN wires with an infinite list of “water swellable elements.”

It is submitted that the Examiner has not identified reasons which would have led one of ordinary skill in the art to *modify* known cable in particular manner to establish *prima facie* obviousness of a new claimed cable. If the prior art fails to suggest precise changes required to obtain the claimed cable, the prior art should not provide a motivation to combine. The fact that any changes to the steps required to modify the prior art into the claimed compound yield compounds of inferior activity can show modification was not obvious. *Takeda Chem. Industries Ltd. V. Alphapharm Pty, Ltd*, 492 F.3d 1350 (Fed. Cir. 2007)

Third, the object of Goehlich is to provide a cable which is used for *detecting* water in the interstices between the outer sheath and inner sheath. It required interstice configuration by the sensor and structured material. The sensor was not required in the presently claimed invention.

Again, it is submitted that the properties, configuration, materials, utility and structure of Appellants' cable are different and unobvious over Goehlich.

The Examiner conceded that there is no disclosure of 1st layer containing adhesive in Chan. See page 6, 1st par; page 15, 1st par. of OA. The Examiner alleged that a POSA would modify Chan with the adhesive of Goehlich in order to achieve the 1st layer containing adhesive of the Appellants' cable.

However, as discussed above, Goehlich disclosed: a) the use of adhesives from an **infinite list** of "structured material" Note cols. 4-6. There is no motivation or suggestion in the prior art to "**pick and choose**" an adhesive from a multitude of element configuration and then particularly use it for the purpose of obtaining the Appellants' cable. *In re Albrecht*, 435 F.2d 908,911, 168 USPQ 293,296 (CCPA 1971); There is no guidance in Goehlich a person of ordinary skill in the art would use for a “**structured material**”. There is no guidance in Goehlich whether an “adhesive” or “swelling agents” should be used as “**structured material**”. In one embodiment, Goehlich used sputtered adhesive and sealing material. In another embodiment, a swellable material was used, in another embodiment, a self adhesive material was used. In addition, the adhesive of Goehlich was applied by itself as a film on the sheath. There is no motivation or suggestion in the prior art on which “structured material” should be selected by one of ordinary skill in the art. Thus, from the above, one of ordinary skill in the art would not be motivated to

“pick and choose” an adhesive such as vinyl or acrylic adhesive of the presently claimed invention. There is no motivation or suggestion to one of ordinary skill in the art to mix the adhesive with low density polyethylene and achieve the presently claimed invention.

When what would have been “**obvious to try**” would have been to vary all parameters or try each of the numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of the many possible choices is likely to be successful, **an invention would not have been obvious**. *In re O’Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

It is impermissible to use the claimed invention as an instruction manual or “template” to piece together the teachings of the prior art so that the claimed invention is rendered obvious. “[one] cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fritch*, 23 USPQ 2d 1780 (Fed. Cir. 1992).

There is no motivation or suggestion to one of ordinary skill in the art to combine power cables of Chan with Goehlich and Belli and arrive at the coaxial cable for use in communication cable of the present invention..

Before obviousness may be established, the Office Action *must show specifically* the principle, known to one of ordinary skill that suggests the claimed combination. *In re Lee*, 277 F.3d 1338,1343 (Fed. Cir. 2002). In other words, the Examiner *must explain* the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention. *Id.* The factual question of motivation is material to patentability and *cannot be resolved based on subjective belief and unknown authority*. *Id.* at 1344.

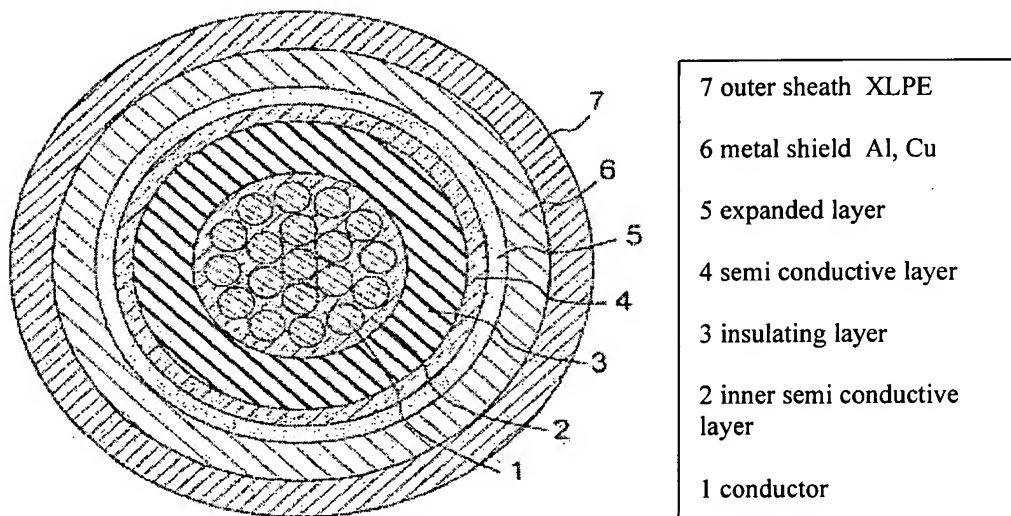
Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined *only if there is some suggestion or incentive to do so*. *ACS Hospital Systems, Inc. v. Montefiore Hospital*. 732 F.2d 1572,1577 (Fed. Cir. 1984). The critical inquiry is whether there is something in the prior art as a whole *to suggest* the desirability, and thus the obviousness, of making the combination. *Fromson v. Advance Offset Plate*. 755 F.2d 1549,1556 (Fed. Cir. 1985). The *Office Action fails to show either a suggestion in the art or a compelling motivation based on sound scientific-principles to combine the references and therefore the rejection under 35 U.S.C. § 103(a) is improper and should be withdrawn*. Appellants respectfully submit that there is no suggestion to combine the

references, and if they could be properly combined, do not lead to the Appellants' invention.

Chan and Goehlich were discussed above. Chan is directed to *power cables* employing CNW (6) which are *not continuous*.

Belli et al. (U.S. 6,455,769)

Belli is directed to an *electrical cable* having a metal shield which is **continuous**. Chan is directed to CNW (6) which **non-continuous**. There is no motivation or suggestion to one of ordinary skill in the art to combine Chan with Goehlich in view of Belli. Goehlich is directed to an inner sheath which is a *continuous* metal or plastic around the cable core.



Belli electrical cable

First, the claims of Belli use “comprises” language (open ended) and required an “expanded layer” which has a degree of expansion between 5% and 500%, preferably from 10% to 200%. This elemental property which is critical to Belli is **not** encompassed by the Appellants' cable. There is no requirement of “expanded layer” which has a degree of expansion between 5% and 500%, preferably from 10% to 200% in the presently claimed invention. The properties of the dry, water resistant cable would not be materially altered if this structure was omitted. The degree of expansion of the expanded layer according to Belli varies and depends on both the specific polymer material used and on the thickness of the coating which it is intended to obtain. The degree of expansion is *predetermined* to ensure that the radial forces of thermal expansion and contraction of the cable are elastically absorbed and simultaneously, so as to maintain the semiconductive properties of the cable. Note Claim 2 and col. 2, lines 52-64; col. 3, lines 25-65. It is submitted that the presently

claimed invention is different and unobvious over Belli et al.

Second, “Expanded polymer material” refers to a polymer material with a predetermined percentage of “free” space inside the material, i.e. of space not occupied by the polymer but by a gas or air. Col. 3, lines 33-38. In accordance with the claim limitation of the presently claimed invention, it is submitted that this polymer material is excluded from the presently claimed invention. Similarly, the “Expanded polymer material” is selected from a broad list of polymers which can turn into an **infinite list** of polymers (hundreds of millions of polymers); Note Cols.4-6. As discussed above, there was no guidance in Belli to one of ordinary skill in art which “expanded polymer” should be picked and selected, which was critical from all the **infinite** possible choices.

Third, the expanded polymer is greater than the inside diameter of the metal shield. This is an important property in order to achieve a predetermined degree of precompression of the expanded layer, resulting in an optimum contact between expanded layer and metal shield. Note Col. 7, lines 43-55.

Fourth, Belli employs fillers in combination with polymer which Appellants' dry water resistant cable avoids. The Appellants' specification on page 1, lines 20-25 to page 2, lines 1-4, discloses as follows:

....The current methods to prevent water penetration in this type of cables [coaxial cables] focus on the use of fillers such as oil dispersed water insoluble materials and stabilizers based on glycol, ester acetate, ethylene glycol, ester or ethylene glycol ester acetate. All these materials show an adequate water protection, the materials have oily adhesive and or characteristic properties. This complicates the use of solvents to clean the cable before connecting it.....

In avoiding the preceding prior art problems, Appellants provide on page 2, lines 21-25, a technique through the design of a dry, water resistant coaxial cable, i.e., **without** a filler. Rather, a water penetration protection element is incorporated which permits installation, preparation and connection of the coaxial cable in the absence of using solvents or other cleaning agents. The water penetration prevention element is between the second external conductor 15 (made of metal or combination thereof) and protective cover 17.

The Examiner conceded that Chan does not disclose 1st layer mixed with vinyl or acrylic adhesive. (Claim 68); nor the adhesive selected from ethylene component chosen between ethylene acrylate acid or ethylene vinyl acid (Claim 70); nor the absorption speed of 15 ml/mg/min and

absorption capacity of more than 30 ml/g (Claim 74); Note page 6, 1st par. to page 7, lines 1-3 Of OA dated May 19, 2009.

The Examiner further conceded that there is no disclosure in Chan regarding the 2nd layer with swelling agent; swelling agent selected from azodicarbonamide, p-toluene sulphonylhydrazide, or 5-phenyltetrazol (**Claim 68**); nor the second polyethylene film applied onto the core conductor shows better watertightness to the swellable dielectric improves its superficial appearance and offers a 13.0 ± 0.10 mm diameter. (**Claim 71**); nor the external conductor is formed by a tape made of aluminum or copper alloy or mixture thereof is formed in a cylindrical pipe and can be longitudinally welded, extruded or the edges can be overlapped and it has a thickness of 0.34 mm and the diameter on the pipe is 13.7 ± 0.10 mm diameter (**Claim 72**); nor the external cover is made of medium density polyethylene and has a diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness (**Claim 74**). Note page 8, 1st full par; of OA dated May 19, 2009

However, the Examiner alleged that a POSA would modify Chan with a swelling agent of Belli in order to achieve the 2nd layer based on polyethylene mix and a swelling agent of the Appellants' dry water resistant **coaxial** cable.

Appellants disagree.

First, there is no motivation or suggestion to one of ordinary skill in the art to employ the *non-continuous* CNW (6) of Chan directed to power cable with the disclosure of Goehlich and Belli which are directed to electric cable employing *continuous* cable sheaths and arrive at the presently claimed coaxial cable for use as a communication cable.

Second, there is no motivation substitute XLPE of Chan et al. for LDPE of the presently claimed invention. As discussed above, XLPE is not functionally equivalent to LDPE. Moreover, there is no suggestion, motivation or guidance to one of ordinary skill in the cited prior art which discloses "expanded polymer" should be selected in order to accomplish the desired results of the presently claimed invention; wherein said "expanded polymer" would be critical to one of ordinary skill in the art such that it would function as employed in the presently claimed coaxial cable for use as communication cable of the present invention.

There is nothing in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination cited by the Examiner. The power cable of Chan does not provide a

motivation or suggestion to a combination with the electric cable taught by Goehlich. It is respectfully submitted that one of ordinary skill in the art would not look to Goehlich to teach and provide suggestions for coaxial cable solutions. Moreover, one of ordinary skill in the art may not look to Belli for teachings about coaxial cable solutions either. The present invention, however, is directed to providing a coaxial cable for use in communication or signal cables without the use of fillers. The cited combination does not provide any mention or suggestion of why these elements would be combined to create the presently claimed coaxial cable of the present invention. Appellants submit that these cited prior art are not analogous art and not in the same field of endeavor as the presently claimed invention.

With respect to Claim 69 directed to the dry coaxial cable wherein the core conductor is copper plated aluminum wire, with a uniform circular cross section of 3.15 ± 0.03 mm diameter. Appellants submit that there is no disclosure or suggestion in the cited prior art regarding this specific cross section. Appellants submit that there is no disclosure or suggestion regarding a copper plated aluminum wire with uniform circular cross section of 3.15 ± 0.03 mm diameter, in the cited prior art. It is submitted that the embodiments of Claim 69 is patentable over the cited prior art.

With respect to Claim 70 directed to the dry coaxial cable wherein the adhesive component is chosen between ethylene acrylate acid or ethylene vinyl acid permitting better adherence and water resistance between the core conductor and the dielectric element, Appellants submit that there is *no* disclosure or suggestion in the cited prior art regarding ethylene acrylate acid or ethylene vinyl acid. It is submitted that the embodiments of Claim 70 is patentable over the cited prior art.

As conceded by Examiner in OA dated May 19, 2009 at page 6, 1st paragraph, Chan et al does not disclose an adhesive, more specifically ethylene acrylate acid or ethylene vinyl acid. In order to establish obviousness, the Examiner combined Chan with Goehlich to show adhesives are well known in the art. The Office Action cited that adhesive component may be selected from ethylene acrylate (Col. 5, lines 8-20)

Upon review of Goehlich at Col. 5, lines 8-20, the disclosure is as follows:

“Such adhesives can be each adhesive, which is resistant against the substance to be detected (like water) and which is adhesive to the used material of the

inner and/or outer sheath, like adhesives based on for example acrylate polymers, methacrylate polymers, polyurethans, silicones, epoxy resins and the like. In case of using a double sided adhesive material the two sheaths are bonded together and are able to seal the interstice between the cable sheaths as well as to allow to increase the friction or bonding between the sheaths. "Self adhesive material" in the sense of this invention includes material which can also be made adhesive by a following extrusion process for extruding the outer sheath."

Appellants disagree. Of the list of adhesives, ethylene acrylate was not mentioned. Rather, a broad *infinite* disclosure list of adhesives was listed. It is also submitted that Chan, Goehlich and Belli are directed to power or electrical cable.

Moreover, Goehlich broadly employs an **infinite list** of "structured material" as follows:
a) swellable material, self adhesive, tape, sputtered adhesive and sealing material. See cols. 5-6. Of all the enumerated "swellable material", a preferred embodiment was the use of sputtered adhesive and sealing material.

With respect to Claim 71 directed to the dry coaxial cable wherein the second polyethylene film applied onto the core conductor shows better watertightness to the swellable dielectric improves its superficial appearance and offers a 13.0 ± 0.10 mm diameter, Appellants submit there is no disclosure or suggestion in the cited prior art regarding the specific diameter. The second layer is physically expanded by gas injection and contains a swelling agent. The cellular expansion polymer lowers the dielectric constant through the reduction of polymer mass per length time; the swelling agent controls the swelling material. It is submitted that the embodiments of Claim 71 is patentable over the cited prior art.

It is well established that when the parameter optimized was not recognized to be result effective variable, optimization would not have been obvious. *In re Antoine*, 559 F.2d 618, 620 (CCPA 1977); see also *In re Sebek*, 465 F.2d 904, 907 (CCPA 1972)("Where.... The prior art disclosure suggests the outer limits of range of suitable values, and the optimum resides within the range, and where there are indications elsewhere that in fact the optimum should be sought within that range, the determination of optimum values outside that range may not be obvious.")

The Office Action alleged at page 9, lines 18, "With respect to Claim 71, Belli teaches diameter of insulation layers may be greater than 14 mm (i.e., the conductor is 14 mm so the insulation surrounding it has to have a diameter greater than 14 mm. Col. 9, line 54."

Claim 71 recited that second polyethylene film which provided water tightness has a diameter of 13 ± 0.10 mm diameter.

However, upon review of Belli at col. 9, line 54, Belli discloses that the **aluminum conductor** which has a 150 mm^2 cross section and 14.0 mm diameter was coated with an inner semiconductive layer (0.6 mm thick); an insulating layer of **XLPE** (4.65 mm thick); an outer semiconductive layer LE 0595 from Borealis, also a **crosslinked polyethylene** (0.4 mm thick). The expanded layer was deposited on the core which has an outside diameter of 25.3 mm. It is submitted that the allegation of the Examiner is misplaced. Belli provides that the **insulating layer of crosslinked polyethylene XLPE** is 4.65 mm, which is **THREE TIMES LESS** than the **non-crosslinked** polyethylene of the present invention.

With respect to Claim 72 directed to the dry coaxial cable wherein the external conductor is formed by a tape made of aluminum or copper alloy or mixture thereof is formed in a cylindrical pipe and can be longitudinally welded, extruded or the edges can be overlapped and it has a thickness of 0.34 mm and the diameter on the pipe is 13.7 ± 0.10 mm diameter, Appellants submit there is no disclosure or suggestion in the cited prior art regarding the specific diameter. Moreover, Appellants submit that **CNW (6) is not equivalent to the external conductor** of the present application. First, CNW is *not* continuous. In contrast, the external conductor is continuous. Finally, Appellants have discussed the importance of optimization of the specific parameter in the presently claimed coaxial cable for use as communication cable. It is submitted that the embodiments of Claim 72 is patentable over the cited prior art.

With respect to Claim 73 directed to the dry coaxial cable wherein the water penetration protective element consists of swellable tapes placed helically, annularly or longitudinally, Appellants submit there is no disclosure or suggestion in the cited prior art regarding the specific embodiment of the water penetration protective element. It is submitted that the embodiments of Claim 73 is patentable over the cited prior art.

With respect to Claim 74 directed to the dry coaxial cable wherein the moisture protection elements have an absorption speed of ≥ 15 ml/g per minute and their absorption capacity is over 30 ml/g, Appellants submit there is no disclosure or suggestion in the cited prior art by the Examiner regarding the specific absorption speed. It is submitted that the embodiments of Claim 74 is patentable over the cited prior art. It is submitted that the polyethylene layer with

adhesive links the conductor to the dielectric and acts as a moisture blocking element and minimizes the presence of air bubbles which contribute to the instability of the characteristic impedance and the structural return losses (SRL).

With respect to Claim 75 directed to the dry coaxial cable wherein the external cover is made of medium density polyethylene and has a diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness, Appellants submit there is no disclosure or suggestion in the cited prior art regarding the specific diameter of the external cover. It is submitted that the embodiments of Claim 75 is patentable over the cited prior art.

Appellants submit that although the court in *In re Aller*, 105 USPQ 233 (CCPA 1955) sets out the rule that the discovery of an optimum value of a variable is normally obvious, courts have held that there are exceptions to this rule in cases where the results of optimizing a variable which was known to be result effective, were unexpectedly good. See *In re Waymouth*, 182 USPQ 290 (CCPA 1974); *In re Saether*, 181 USPQ 36 (CCPA 1974). Another exception is one in which the parameter optimized was *not* recognized to be a result effective variable. *In re Antoine*, 195 USPQ 6 (CCPA 1977). It further stated that §103 directs attention to the invention "**as a whole**" which includes not only to the subject matter which is literally recited in the claim in question but also those properties of the subject matter *and* are disclosed in the specification and claimed with the transitional phrase "consisting of".

Therefore, Appellants submit that none of the references alone or in combination renders the presently claimed subject matter obvious. Similarly, dependent claims necessarily recite all the features of the independent claim from which they depend. Further, Appellants submit that the claims dependent on Claim 1 are likewise patentable over the cited prior art references.

In this case, the invention "as a whole" which includes optimum values such as the uniform circular cross section of $3.15 \pm 0.03 \text{ mm}$ diameter (**Claim 69**); $13.0 \pm 0.10 \text{ mm}$ 2nd layer diameter(**Claim 71**); external conductor thickness of 0.34 mm and the diameter on the pipe is $13.7 \pm 0.10 \text{ mm}$ diameter (**Claim 72**); absorption speed and capacity of $> 15 \text{ ml/g}$ per minute and over 30 ml/g (**Claim 74**); the external cover diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness (**Claim 75**), provide distinct unexpected properties and advantages over the cited references. These properties were not suggested in the cited prior art which are directed to power cables.

Appellants have presented arguments and evidence in their response to establish that the Examiner has failed to establish a *prima facie* case of obviousness. Appellants submit that the Examiner has failed to fully address and consider such arguments and evidence as directed by law. Appellants have amended the claims to “consisting of.”

In order to support a rejection under 35 U.S.C. §103, a basis for a suggestion to make the claimed invention must be found in the prior art. In addition, one of ordinary skill in the art would have had to have a reasonable expectation of success of making the claimed invention. It is submitted that neither of these elements are found in the art cited by the Examiner.

Appellants request the Board to reconsider upon review of all the evidence whether one of ordinary skill in the art would have been motivated to use an “adhesive” from an **infinite** list of “structured material” in power cables of Goehlich (prefers sputtered adhesive and sealing material) and that they would have been able to do so with a reasonable expectation that the coaxial cable would function effectively without significantly affecting the other components contained therein, as well as the transmission efficiency and properties.

Furthermore, an ability of one of ordinary skill in the art to incorporate the adhesive of Goehlich in the cable of Chan et al. does not lead the artisan to achieve the presently claimed invention because there are several factors to be considered, e.g., a) utility of the cable; b) design of the cable, e.g., choice of elements or layers; b) choice of swellable materials or adhesive; or c) use of encapsulation jacket.

A person of ordinary skill in the art would not have been motivated to combine the disparate teachings of Goehlich, Chan and Belli, directed to *power* cables in order to obtain the advantage of coaxial cables for use as communication or signal cable by “providing an optimized way of transmitting RF signals, cable data signals, cellular telephone signals, internet or data signals without the use of fillers” because only Appellants teach how to arrive at the claimed invention as set forth in claims 68-77. It is submitted that modifying the teachings of Chan with Goehlich or Belli do not support a legal conclusion of obviousness. *KSR Int’l v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007).

As discussed above, it is an on-going goal in the art to prevent water penetration in the cable art. It is not a matter of incorporation or substitution of an element or layer. These problems in the prior art can not be solved by simple substitution without experimentation.

Rather, it is submitted that the specified claimed modifications in the presently claimed invention must be specifically motivated or suggested by the prior art.

Moreover, even if the references did indicate that such an incorporation may be tried, an “obvious-to-try” standard would be indicated, which is clearly not a sufficient basis for the rejection. The specified claimed modifications must be specifically motivated or suggested by the prior art. It is submitted that a person skilled in the art would have to resort to “impermissible hindsight reconstruction based on Appellants’ own teachings” to arrive at the specifically claimed invention.

From the above, the Examiner has not shown any prior art to show a motivation or suggestion in the prior art to show the incorporation of the teaching of Belli or Goehlich in the disclosure of Chan and arrive at the presently claimed invention. In accordance with *In re Oetiker, supra*, the Examiner has not met the requisite burden of proof as required by a *prima facie* case of obviousness.

From the above, it is submitted that the presently claimed invention is unobvious over the cited prior art. The Examiner has not shown a *prima facie* case of obviousness. All of the prior art cited by the Examiner are directed to power or electric cable. In contrast, the present invention is directed to coaxial cable for use as a communication cable. Nowhere does the prior art disclose “coaxial cable”. As discussed above, power cables are different from communication cables. The communication signals can include video, voice and data signals. coaxial cable communications system and serve different purposes therein. Moreover, distribution cables typically extend across relatively long distances and, accordingly, and must transmit the RF signals with a minimum of resistance and attenuation.


CONCLUSION

Appellants have presented the above reasons why the claims are not rendered obvious by the cited references. It is submitted that the Examiner ignored the claim limitations of the present application. For example, the limitations “coaxial cable”, “consisting of”, “low density polyethylene”, “circular cross section”, “diameter of the second polyethylene”, “thickness and diameter of the pipe”, and “absorption capacity” were ignored by the Examiner in reviewing the presently claimed invention. The resulting properties of the presently claimed invention would

be affected if the proposed modification by the Examiner were incorporated. These modifications teach away from the presently claimed invention. Each of the arguments alone is sufficient to establish that a *prima facie* case of unpatentability has not been made. In combination, they present a compelling argument that the claims are patentable over the prior art. It is submitted that the Examiner has not presented sufficient arguments or reasoning to contradict the evidence provided by Appellants that the prior art fails to provide a suggestion for providing an improved dry water resistant coaxial cable and method of manufacture thereof with unexpected properties.

WHEREFORE, in light of the arguments and authorities presented above, reversal of the Examiner's action in rejecting claims 68-75 and allowance thereof are respectfully urged.

Respectfully submitted,



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CLAIMS APPENDIX

Claim 68 A dry, water resistant coaxial cable consisting of: a metal core conductor element, a dielectric element around the core conductor based on three layers, the first layer being applied onto the conductor as a uniformly thick film based on low density polyethylene mixed with a vinyl or acrylic adhesive, the second layer being based on an expanded polyethylene mix consisting of low density polyethylene or mixture of low, medium and high density polyethylenes and a swelling agent selected from azodicarbonamide, p-toluene sulphonylhydrazide, or 5-phenyltetrazol, and optionally a reinforcement layer of the same characteristics as the first layer; wherein it has a second external conductor element formed by a tape made of an aluminum or copper alloy or combined with other elements and surrounding said conductor consisting of a water penetration protective element keeping it dry and based on one or several swellable fibers or tapes formed by polyester threads or other swellable fibers; and the protective cover based on low, medium, high density polyethylene or a combination thereof.

Claim 69 The dry coaxial cable according to claim 68 wherein the core conductor is copper plated aluminum wire, with a uniform circular cross section of 3.15 ± 0.03 mm diameter.

Claim 70 The dry coaxial cable according to claim 68 wherein the adhesive component is chosen between ethylene acrylate acid or ethylene vinyl acid permitting better adherence and water resistance between the core conductor and the dielectric element.

Claim 71 The dry coaxial cable according to claim 68 wherein the second polyethylene film applied onto the core conductor shows better watertightness to the swellable dielectric improves its superficial appearance and offers a 13.0 ± 0.10 mm diameter.

Claim 72 The dry coaxial cable according to claim 68 wherein the external conductor is formed by a tape made of aluminum or copper alloy or mixture thereof is formed in a cylindrical pipe and can be longitudinally welded, extruded or the edges can be overlapped and it has a thickness of 0.34 mm and the diameter on the pipe is 13.7 ± 0.10 mm diameter.

Claim 73 The dry coaxial cable according to claim 68 wherein the water penetration protective element consists of swellable tapes placed helically, annularly or longitudinally.

Claim 74 The dry coaxial cable according to claim 73 wherein the moisture protection elements have an absorption speed of ≥ 15 ml/g per minute and their absorption capacity is over 30 ml/g.

Claim 75 The dry coaxial cable according to claim 68 wherein the external cover is made of medium density polyethylene and has a diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness.

IX EVIDENCE RELIED UPON

The evidence relied upon are as follows:

Chan et al. (U.S. 5,486,648)

Goehlich (U.S. 6,784,371)

Belli et al. (U.S.6,455,769)

X RELATED PROCEEDING INDEX

There are no related proceeding which will directly affect this appeal.



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(54) **Dry water-resistant coaxial cable and manufacturing method of the same**

Trockenes wasserfestes Koaxialkabel und Verfahren zur Herstellung desselben

Cable coaxiale sec résistant à l'eau et son procédé de fabrication

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Description**BACKGROUND OF THE INVENTION****FIELD OF THE INVENTION**

[0001] Currently, cable TV networks are designed taking into account the use of coaxial cables for signal transmission from the generation building to the subscribers. Said coaxial cables are classified in trunk, distribution and drop cables, and are usually made up of a core conductor, a dielectric insulation, and external conductor and a protective cover.

PREVIOUS ART

[0002] In order to connect coaxial cables to the transmission or reception equipment, it is necessary to prepare the cable to place and then seal the connectors to prevent water penetration. However, water penetration problems are common due to poor seal together with an inadequate cable installation. For example, when the cable is placed in ducts exposed to prolonged humidity such as flooding, if water penetration occurs, the cable is affected in its electrical and mechanical properties.

[0003] The current methods to prevent water penetration in this type of cables focus on the use of fillers such as oil dispersed water insoluble materials, and stabilizers based on glycol, ester acetate, ethylene glycol ester or ethylene glycol ester acetate. All these materials show an adequate protection against water penetration in coaxial cables, however all of them use materials with oily adhesive and/or characteristic properties. This complicates the use of solvents to clean the cable before connecting it.

[0004] For example, in U.S. Patent 5,949,018, a coaxial cable having water blocking cover is described, which includes, besides the conductor and the dielectric material around it, a first metal cover around the dielectric material and the conductor; a first metallic tape cover around and a second metallic cover around the tape; a water swellable material placed between the two covers and a second metallic tape, and a final jacket.

[0005] In patent application PCT/US01/11879, a coaxial cable is described. Said coaxial cable is protected against corrosion through the use of a composition applied on the cable, said composition being based on an oil dispersed anti-corrosion compound and a glycolic ethers stabilizer, propyleneglycol based on glycolic ester acetate or ethylene. Said composition is applied preferably on the external conductor of said cable.

[0006] The applicant had developed a technique through the design of a dry cable, i.e. without filler, but incorporating within its design a water penetration prevention element, which would permit to prepare and connect the coaxial cable without using solvents and other cleaning elements.

DESCRIPTION OF THE INVENTION

[0007] Hereinafter, the invention is described according to figures 1, 2, 3 and 4 wherein:

Figure 1 is a perspective view with cross section of the dry coaxial cable.

Figure 2 is a side view with cross section of the cable of Figure 1.

Figure 3 is a block diagram of the manufacturing process of the dry coaxial cable in its first phase.

Figure 4 is a block diagram of the manufacturing process of the dry coaxial cable in its second phase.

[0008] The coaxial cable 10 of Figures 1 and 2 is characterized because it includes a protection to prevent water penetration, specifically between the external conductor 15 and the cover 17. Said cable also includes enough elements to ensure protection against water penetration and the method through which said protective element against water penetration is placed between the external conductor and the cover is presented.

[0009] The coaxial cable 10 is normally formed by a metal core conductive element 11 which can be manufactured from different materials such as: copper alloys, aluminum alloys, or combinations of said metals with others. Said core conductor can be protected by a surrounding layer 12 of a polymer mix with an adhesive component of ethylene acrylate acid (EAA) or ethylene vinyl acid (EVA), among others, to ensure a correct watertightness between the core conductor and the dielectric. The dielectric consists of a cellular high expansion polymer, said high expansion polymer can be formed by a low density polyethylene or mixture of low, medium and high density polyethylene plus a swelling agent for controlling the swelling material that can be azodicarbonamide, p-toluene sulfonyl hydrazide, 5-phenyl tetrazol, among others. Between the dielectric and the second conductor, there can be or not a layer or film of polymer mixed with a certain proportion of adhesive such as ethylene acrylate acid (EAA) or ethylene vinyl acid (EVA), among others. The object of said second polyethylene film is to give watertightness to the swelling dielectric and to improve the surface appearance of the dielectric, and also to permit a better control of the dielectric swelling process. The second or external

conductor 15 can be formed by a tape made of aluminum alloy, copper alloy or any combination of said metals with others, formed in a tube that can be longitudinally welded, extruded or with overlapping edges. On said second conductor a water penetration protective element is placed, said protection consisting of one or several swellable fibers or tapes made of polyester threads or other fibers as basis for the swellable element applied helically, annularly or longitudinally. Finally, on the external conductor a protective cover is placed which can be of any type of polymer such as low density, medium density and high density polyethylene or any combination of them.

[0010] Figure 1 shows the dry coaxial cable 10 with the water penetration protection object of the instant invention. Said cable can be used as trunk or distribution cable in transmission networks for radio frequency signals, specifically for analog or digital television transmission signals as well as energy signals for activating control peripheral equipment. It can also be used for Internet signal transmission, data transmission, cellular phone, etc. Said cable is made of a solid or hollow core conductor 11 which must be manufactured with materials showing good electric conductivity, such as copper, aluminum or a combination of them. Said core can even consist of a steel part commercially known as copper plated steel or steel plated with other metal. Figure 1 shows a solid core conductor 11, because it is the most common type. Said core conductor is protected by a low dielectric coefficient polymer film 12 which can be polypropylene or polyethylene in order to have a maximum signal propagation and a minimum attenuation. Said polymer film 12 has to be as thin as possible to maintain the transmission characteristics, but its application onto the core conductor has to be continuous and homogeneous, because otherwise electrical problems will occur such as cable signal reflection. The main object of this film 12 is to protect the core conductor against corrosion and to control the adherence between the core conductor and the dielectric. It is thus possible to add a given amount of adhesive to the film polymer, said adhesive being ethylene acrylate acid (EAA) or ethylene vinyl acid (EVA), among others. The main insulation 13 is a cellular high expansion polymer made of low dielectric coefficient polymers such as polypropylene, polyethylene or polyester, said insulation 13 having a high cellular expansion in order to lower the dielectric constant through a reduction of the polymer mass per length unit. Preferably, low density polyethylene is used or a mixture of low, medium or high density polyethylene plus a swelling agent to control the swelling, which can be azodicarbonamide, p-toluene sulfonyl hydrazide, 5-phenyl tetrazol, among others. Between the dielectric 13 and the second conductor 15, there can be or no a layer or film 14 of any mixed polymer and it can be combined with a quantity of any adhesive such as ethylene acrylate acid (EAA) or ethylene vinyl acid (EVA), among others. Said second film 14 is formed of any low dielectric coefficient polymer such as polyethylene, having the object of giving water resistance to the swollen dielectric and improving the surface appearance of the dielectric, besides permitting a better control of the swelling process of the dielectric. This second conductor 15 covers the dielectric insulation and is constituted by a metal pipe formed around the dielectric, which can be welded longitudinally, extruded or with overlapping edges. Said second conductor 15 is made of conductive material such as aluminum, copper, or any combination of them, and can also be a braided mesh of metal wires made of copper, aluminum, or other metal alloys.

[0011] According to the invention, Figures 1 and 2 show the water penetration protective element 16 which is applied helically. However it can also be applied annularly or longitudinally on the second conductor. Said protective element consists of one or several swellable fibers or tapes formed by polyester threads or other fibers. As basis of the swellable element, polyacrylate fibers such as polyacrilamide, polyacrylic acid, among others, can be used.

[0012] The protective layer 17 shown in Figure 1 must perfectly cover the second conductor 15 having a smooth and uniform appearance. Said second conductor can contain or not one or several identification fringes of the same material but different color. Said protective cover 17 gives firmness to the cable and must be formed of a thermoplastic material resistant to temperature, fire and ultraviolet light, to extreme environmental conditions, to rodents, to cuts as well as to chemicals substances. It must also present good stress resistance, besides showing low fume emissions. The thermoplastic materials used can be low, medium or high density polyethylene or any combination of these or other types of thermoplastic elements.

[0013] Figure 3 shows a diagram of the way the core or insulation for the coaxial cable of the instant invention is manufactured. Figure 4 shows the diagram of the application process for the second conductor, the water penetration protective element and the protective cover, In both cases the description is given from left to right. First, Figure 3, there is the feeding reel 18 containing the core conductor 11. In order to give continuity to the process, the end of the conductor is coupled to the beginning of the conductor of the new reel through welding ensuring the absence of deformation and maintaining the requested diameter in order to conserve electrical as well as mechanical characteristics. The core conductor 11 passes then through the first polymer film applicator 19. Said film can be applied through extrusion, flooding the conductor in the insulating material and then removing the excess material or through sprinkling, as previously mentioned. This first film can be formed of polyethylene, polyester or polypropylene mixed in a given ratio with an adhesive which can be ethylene acrylate acid (EAA), among others.

[0014] The main insulating element 12 or dielectric is placed in the extrusion device 20 which can be a single extruder (simple) or two serial extruders which are known as cascade, to obtain high cellular expansion. Normally, high, low or medium density polyethylene is used, or any combination of them with a swelling control agent that can be azodicarbonamide, p-toluene sulfonyl hydrazide, phenyl tetrazol, among others, to reach high cellular expansion. Besides the above-

mentioned materials, a physical expansion can be generated injecting a high pressure inert gas in the extrusion process, the gas used being Nitrogen, Argon, Carbon Dioxide, among others or any combination of these. However, there also exists the chemical swelling which is conducted directly by the swelling agent as the above-mentioned azodicarbonamide. The second polymer film is optional and is applied on the equipment 27. Said second polymer film can be equal to the first film and applied through extrusion, flooding the conductor in the insulating element and then removing the excess or through sprinkling. If it is through extrusion, said film is applied through co-extrusion, i.e., there are two extruders, one for the main insulating element 13 and the other for the second polymer film 14. Said extruders are connected to a single extrusion head appropriately designed for this purpose, as previously mentioned, said second film consisting of polyethylene, polyester or polypropylene mixed in a given ratio with an adhesive which can be ethylene acrylate acid (EAA), among others. Other option to manufacture the core is through triple co-extrusion, in which there are three extruders, one for the first film 12 another for the main insulation material 13, and the other for the second film 14, connected to an extrusion head properly designed to obtain the core with the 3 above-mentioned interfaces.

[0015] Once the core or central insulation 11 is obtained, it must be cooled to prevent deformation when winding it, which is made in the cooling trough 22 and water at controlled temperature, air, vapor, or any combination of them can be used. Finally, the core is stored on a reel 23 to be sent to the following process.

[0016] The diagram in Figure 4 starts with the feeding reel 23 containing the core 11 onto which a pipe denominated second conductor 15 is placed. Said pipe can be made of aluminum, copper or any combination of them. According to the initial description of the product, there are three options for the application of the second conductor: welded tape, overlapped tape, or through extrusion. In the case of welded or overlapped tape conductor, Figure 4 shows the tape winding equipment 24 which receives the tape 25 in rolls and unwinds it to be introduced to the process. Said tape 25 is formed around the core 11 through the appropriate equipment 26, for example through forming rollers or dice. With regard to a welded second conductor 15, this welding process is conducted on the equipment 29 through a high frequency or Tig process.

[0017] After welding, the pipe is submitted to a trimming step in which burrs or welding process imperfections are eliminated giving a round and uniform pipe. Then, the core-external conductor complex passes through a diameter adjustment box which can contain 1 to 4 dice which reduce the pipe diameter to adjust and even compress the core 11 insuring a good contact and coverage of the core 11. During this process, a lubricant has to be used to prevent damage to the pipe and the dice. If the second conductor is applied through overlapping of the edges, it will go directly from the forming equipment 26 to the diameter adjustment box 28 where it will be adjusted to the core 11, being ready for the following process step. In this case, no lubricant is used.

[0018] If the second conductor 15 is applied through extrusion, the material used will be preferably an aluminum alloy and the process will include a device 29 for unwinding the wire rod 30 to be introduced to the process. Said wire rod 30 together with the core 11 penetrate into an appropriate extrusion device 31 in which the wire rod is extruded around the core, forming a pipe. Then, the core-external conductor complex passes through the diameter adjustment box 28 which can contain 1 to 4 dice which reduce the pipe diameter to adjust and even compress the core 11 insuring a good contact and coverage of the core 11. During this process, a lubricant has to be used to prevent damage to the pipe and the dice.

[0019] The cable 32 indicated in Figure 4 passes through the adequate device 33 for its application onto the second conductor 15 of the water penetration protective element 16 object of the instant invention. Said protective element consists of one or various swellable fibers or tapes made of polyester threads or other fibers as basis of the swellable element. Said fibers or tape are preferably applied helically, however they can also be applied annularly or longitudinally. Once the water penetration protective element 16 is applied, the cable passes through an extruder 34 where the protective cover 17 is applied. Said cover is formed of a resistant thermoplastic element which can be low, medium or high density polyethylene or any combination of them or other types of thermoplastic elements. If necessary one or several identification fringes made of the same material but of different colors, can be made through co-extrusion using the same extrusion head.

[0020] Once the cable 36 is obtained, it is protected by the cover and has to be cooled to prevent deformations when winding it, and this is conducted in a cooling trough 35 using water at controlled temperature. Finally the cable 36 is stored on a reel 37 to be stored, cut or shipped.

MATERIAL CHARACTERISTICS AND CABLE CONSTRUCTION

[0021] > Internal Conductor (core)

[0022] The core conductor is made of copper plated aluminum wire, with a 3.15 ± 0.03 mm diameter; it also has a uniform round cross section, seamless and imperfection free, and meets the requirements of ASTM B 566 standard, Class 10A.

➤ Dielectric

5 [0023] The dielectric consists of three layers. The first layer, the conductor, is a uniformly thick film made of low density polyethylene mixed with adhesive. Said layer links the conductor to the dielectric and acts as a moisture blocking element and minimizes the presence of air bubbles that contribute to the instability of the characteristic impedance and the structural return losses (SRL). The second layer of the dielectric is a polyethylene mix physically expanded through gas injection. The materials used have to be virgin. Recycled or reprocessed materials shall not be used. The dielectric is to be applied concentrically on the conductor, adhering onto it, and shall have a 13.0 ± 0.10 mm diameter. The third layer has the same properties as the first layer and ensures the surface uniformity of the intermediate layer and enhances the adherence of the aluminum pipe onto the dielectric. The polyethylene mix used in the dielectric shall fulfill the requirements of standard ASTM D 1248 Type I, III and IV, Class A, category 3.

➤ External Conductor

15 [0024] The external conductor is a cylindrical pipe made of aluminum alloy 1350, and shall meet the requirements of ASTM B 233. The thickness of the pipe shall be 0.34 mm and its diameter shall be $13.70 \text{ mm} \pm 0.10 \text{ mm}$.

➤ Water blocking threads

20 [0025] The external conductor is helically surrounded with a pair of water blocking threads. Said threads have an absorption speed $\geq 15 \text{ ml/g}$ per minute and their absorption capacities is about 30 ml/g.

➤ External cover

25 [0026] The external cover is made of medium density black polyethylene, adding the precise ratios of antioxidant and carbon black to ensure the best conditions against weathering, including protection against UV rays.

[0027] The surface of the cover shall be free of holes, cracks and any other defect.

[0028] The cover diameter shall be $15.5 \text{ mm} \pm 0.10 \text{ mm}$, with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness.

30 [0029] The polyethylene used for the cover shall meet the following characteristics:

| Characteristic | Value | Test method |
|-----------------------------|---------------|-----------------------------|
| Density (g/cm^3) | 0.900 - 0.955 | ASTM D 1505 |
| Minimum elongation (%) | 400 | ASTM D 638 |
| Minimum elongation | 75 | ASTMD 573 |
| Retention (%) | | After 48 hours at 100 °C |
| Carbon Black Contents (%) | 2.35 - 2.85 | ASTM D 1603 |

40 Physical Tests:

Cable bending test

45 [0030] The complete cable must fulfill all the requirements established in standard EN 50117, Clause 10.2 for the bending test.

Cable tensile stress test

50 [0031] The cable shall withstand a maximum tensile stress of 980 N, without presenting changes in the electrical characteristics specified in this document. Besides, the cable shall not present cracks or ruptures in the insulation, in the metal elements or in the cover, after having been submitted to the tests described in standard EN 50117, Clause 10.3.

55 Compressive strength test

[0032] The cable must pass the compressive strength test conducted according to standard EN 50117, Clause 10.4. After a maximum recovery time of 5 minutes, the maximum irregularity will be below 1%.

Insulation longitudinal contraction test

[0033] Samples of insulated conductor shall be submitted to contraction test according to the procedures specified in ASTM D 4565. The total contraction of the insulation shall not be over 6.4 mm.

Cover longitudinal contraction test

[0034] The cable cover shall be tested to measure its longitudinal contraction, following the procedure established in standard SCTE IPS-TP-003. The contraction shall not be above 9.52 mm in a 152 mm long sample.

Test of adherence between the core conductor and the insulation

[0035] The core conductor shall adhere onto the dielectric material insulating the cable. Said adherence shall be strong enough to prevent sliding between the two elements, but must also allow the separation of said two elements during cable preparation for connection. The test shall be conducted according to standard EN 50117, Clause 10.1.

Weathering test

[0036] The finished cable shall be submitted to the weathering test according to the procedures established in standard EN 50117, Clause 10.6. This test is conducted in order to determine the capacity of the cable to maintain its electrical characteristics and the cover integrity in case of weather changes.

Electrical Characteristics of the finished product

[0037] The cable shall present the following electrical characteristics when they are evaluated according to standard EN 50117-1:

| | |
|---|-----------------------|
| Core conductor DC resistance @ 20 °C | 3.34 Ω/km |
| External conductor DC resistance @ 20 °C | 1.94 Ω/km |
| Minimum electrical resistance of the Insulation | 10 ⁴ MΩ/km |
| Capacitance @ 1KHz | 50.00 ± 3.0 pF/km |
| Characteristic impedance @ 1 ≥ f ≤ 1000; f(MHz) | 75.00 ± 2.0 Ω |
| Propagation speed | 88 % |

Attenuation @ 20°C

| Frequency (MHz) | DB/100 m |
|-----------------|----------|
| 5 | 0.46 |
| 30 | 1.12 |
| 55 | 1.53 |
| 108 | 2.16 |
| 150 | 2.57 |
| 211 | 3.12 |
| 250 | 3.38 |
| 300 | 3.71 |
| 350 | 4.02 |
| 400 | 4.31 |
| 450 | 4.57 |
| 500 | 4.88 |
| 550 | 5.12 |
| 600 | 5.31 |
| 750 | 6.07 |
| 800 | 6.28 |
| 862 | 6.56 |

(continued)

Attenuation @ 20°C

Frequency (MHz) DB/100 m

900 6.85

950 6.93

1000 7.12

Return losses @ 20 °C

Frequency (MHz) dB

5 - 1000 ≥ 30

Mechanical characteristics of the product

[0038] The cable shall present the following mechanical characteristics tested according to standard EN50117-1:

Maximum stress without change in electrical properties 980 N

Minimum bending radio 102 mm

Adherence onto the dielectric ≥ 1.3 Mpa

[0039] The cable shall be designed to operate at temperatures between -40 to 80 °C and shall present a nominal net weight of 140 Kg/Km.

Claims

1. Dry water resistant coaxial cable consisting of: a metal core conductor element, a dielectric element around the core conductor based on three layers, the first layer being applied onto the conductor as a uniformly thick film based on low density polyethylene mixed with a vinyl or acrylic adhesive, the second layer being based on an expanded polyethylene mix consisting of low density polyethylene or mixture of low, medium, and high density polyethylenes and a swelling agent based on azodicarbonamide, p-toluene sulphonyl hydrazide, or 5-phenyl tetrazol, and optionally a reinforcement layer of the same characteristics as the first one; **characterized in that** it has a second external conductor element formed by a tape made of an aluminum, or copper alloy or combined with others elements and surrounding said conductor, consisting of a water penetration protective element keeping it dry and based on one or several swellable fibers or tapes formed by polyester threads or other swellable fibers; and the protective cover based on low, medium, or high density polyethylene or a combination of them.
2. The dry coaxial cable according to claim 1, **characterized in that** the core conductor is copper plated aluminum wire, with a uniform circular cross section of 3.15 ± 0.03 mm diameter.
3. The dry coaxial cable according to claim 1, **characterized in that** the adhesive component is chosen between ethylene acrylate acid or ethylene vinyl acid permitting a better adherence and water resistance between the core conductor and the dielectric element.
4. The dry coaxial cable according to claim 1, **characterized in that** the second polyethylene film applied onto the core conductor, shows a better watertightness to the swellable dielectric, improves its superficial appearance and offers a 13.0 ± 0.10 mm diameter.
5. The dry coaxial cable according to claim 1, **characterized in that** the external conductor formed by a tape made of aluminum or copper alloy or mixture of them is formed in a cylindrical pipe and can be longitudinally welded, extruded or the edges can be overlapped and it has a thickness of 0.34 mm and the diameter on the pipe is $13.70 \text{ mm} \pm 0.10 \text{ mm}$.
6. The dry coaxial cable according to claim 1, **characterized in that** the water penetration protective element consists of swellable tapes placed helically, annularly or longitudinally.
7. The dry coaxial cable according to claim 6, **characterized in that** the moisture protection elements have an ab-

sorption speed of ≥ 15 ml/g per minute and their absorption capacity is over 30 ml/g.

8. The dry coaxial cable according to claim 1, **characterized in that** the external cover is preferably made of medium density black polyethylene and has a diameter on cover of $15.5 \text{ mm} \pm 0.10 \text{ mm}$ with a $0.67 \text{ mm} \pm 0.02 \text{ mm}$ thickness.
9. A manufacturing method for the dry coaxial cable according to claims 1 to 8, consisting of the following steps: preparing a core conductor feeding reel welding its end onto another reel so that the manufacturing can be continuous, passing the core conductor onto a first polyethylene film application through extrusion, the polymer being chosen among polyethylene, polyester or polypropylene mixed with an ethylene acrylate acid adhesive; extruding, based on high, low or medium density polyethylene mix with a swellable agent such as azodicarbonamide, p-toluene sulphonylhydrazide or 5-phenyl tetrazol with high pressure inert gas injection to improve cellular expansion, optionally a second film having the same characteristics as the first one through co-extrusion; cooling at room temperature; the core obtained is wound and a pipe shaped external conductor made of aluminum, copper or a combination of them is applied, said pipe can be formed through welding, or overlapping of the edges or through extrusion; application of helical, annular or longitudinal water penetration protection element; and application of the protective cover through extrusion of low, medium or high density polyethylene or a combination of them.
10. The manufacturing method for the dry coaxial cable according to claim 9, **characterized in that** the core can be manufactured through triple co-extrusion in three extruders, one for the first film, another for the main insulation and the other for the second film, which are connected to an extrusion head.

Patentansprüche

1. Trockenes wasserbeständiges Koaxialkabel, bestehend aus: einem Metallkern-Leiterelement, einem dielektrischen Element um den Kernleiter herum basierend auf drei Schichten, wobei die erste Schicht auf den Leiter als gleichförmig dicker Film basierend auf Polyethylen mit niedriger Dichte gemischt mit einem Vinyl- oder Acryl-Klebstoff aufgetragen ist, die zweite Schicht auf Basis eines expandierten Polyethylen-Gemisches bestehend aus Polyethylen mit niedriger Dichte oder einem Gemisch aus Polyethylenen mit niedriger, mittlerer und hoher Dichte und einem Quellmittel basierend auf Azodicarbonamid, p-Toluol-Sulfonylhydrazid oder 5-Phenyl-Tetrazol sowie optional einer Verstärkungsschicht mit denselben Eigenschaften wie die erste Schicht gebildet ist, **dadurch gekennzeichnet, dass** es ein zweites äußeres Leiterelement besitzt, das aus einem Band aus Aluminium oder einer Kupferlegierung oder kombiniert mit anderen Elementen gebildet ist und den Leiter umgibt, bestehend aus einem Wassereintritt-Schutzelement, das es trocken hält und auf Basis einer oder mehrerer quellfähiger Fasern oder Bändern gebildet ist, die durch Polyester-Fäden oder andere quellbare Fasern gebildet sind, und wobei die Schutzabdeckung auf Basis von Polyethylen niedriger, mittlerer oder hoher Dichte oder einer Kombination daraus gebildet ist.
2. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kernleiter ein kupferbeschichteter Aluminiumdraht ist und einen gleichförmigen kreisförmigen Querschnitt von $3,15 \pm 0,03 \text{ mm}$ Durchmesser hat.
3. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** die Klebstoff-Komponente ausgewählt ist zwischen Ethylenacrylat-Säure oder Ethylenvinyl-Säure, die eine bessere Haftung und Wasserbeständigkeit zwischen dem Kernleiter und dem dielektrischen Element ermöglichen.
4. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** der auf den Kernleiter aufgetragene zweite Polyethylen-Film eine bessere Wasserdichtigkeit gegenüber dem quellbaren Dielektrikum aufweist, sein oberflächliches Erscheinungsbild verbessert und einen Durchmesser von $13,0 \pm 0,10 \text{ mm}$ aufweist.
5. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** der aus einem Band aus Aluminium oder einer Kupferlegierung oder einem Gemisch davon bestehende äußere Leiter in einem zylinderförmigen Rohr gebildet ist und in Längsrichtung verschweißt, extrudiert oder mit seinen Kanten überlappt werden kann, und eine Dicke von $0,34 \text{ mm}$ hat, wobei der Durchmesser auf dem Rohr $13,70 \text{ mm} \pm 0,10 \text{ mm}$ beträgt.
6. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** das Wassereintritt-Schutzelement aus quellbaren Bändern besteht, die schraubenförmig, ringförmig oder in Längsrichtung angebracht sind.
7. Trockenes Koaxialkabel nach Anspruch 6, **dadurch gekennzeichnet, dass** die Feuchtigkeit-Schutzelemente eine Absorptionsgeschwindigkeit von $\geq 15 \text{ ml/g pro Minute}$ haben und ihre Absorptionsgeschwindigkeit über 30 ml/g liegt.

8. Trockenes Koaxialkabel nach Anspruch 1, **dadurch gekennzeichnet, dass** die äußere Abdeckung vorzugsweise aus schwarzem Polyethylen mittlerer Dichte besteht und einen Durchmesser auf der Abdeckung von $15,5 \text{ mm} \pm 0,10 \text{ mm}$ mit einer Dicke von $0,67 \text{ mm} \pm 0,02 \text{ mm}$ hat.

- 5 9. Herstellungsverfahren für das trockene Koaxialkabel nach Anspruch 1 bis 8, bestehend aus den folgenden Schritten: Vorbereiten einer Kernleiter-Zufuhrwicklung und Anschweißen ihres Endes an eine andere Wicklung, so dass die Herstellung kontinuierlich erfolgen kann; Weiterführen des Kernleiters zu einer ersten Polyethylen-Filmauftragung durch Extrusion, wobei das Polymer aus Polyethylen, Polyester oder einem Polypropylen im Gemisch mit einem Ethylenacrylat-Säure Klebstoff ausgewählt wird; optionales Extrudieren eines zweiten Films mit denselben Kenn-
10 größen wie der erste Film durch Co-Extrusion auf der Basis eines Gemischs von Polyethylen niedriger, mittlerer oder hoher Dichte mit einem Quellschmelzmittel wie Azodicarbonamid, p-Toluol-Sulfonylhydrazid oder 5-Phenyltetrazol und mit Hochdruck-Inertgas-Einleitung zur Verbesserung der Zellexpansion; Kühlen bei Raumtemperatur; wobei der gewonnene Kern gewickelt wird und ein rohrförmiger äußerer Leiter aus Aluminium, Kupfer oder einer Kombination daraus aufgetragen wird, wobei das Rohr durch Schweißen oder Überlappen der Ränder oder durch Extrusion
15 gebildet werden kann; Auftragen eines schraubenförmigen, ringförmigen oder längsförmigen Wassereintritt-Schutzelements; und Auftragen der Schutzabdeckung durch Extrusion von Polyethylen niedriger, mittlerer oder hoher Dichte oder einer Kombination davon.

- 20 10. Herstellungsverfahren für das trockene Koaxialkabel nach Anspruch 9, **dadurch gekennzeichnet, dass** der Kern durch Dreifach-Coextrusion in drei Extrudern hergestellt werden kann, wovon einer für den ersten Film, ein anderer für die Hauptisolierung und ein weiterer für den zweiten Film bestimmt ist, und die mittels eines Extrusionskopfes verbunden sind,

25 Revendications

1. Câble coaxial sec résistant à l'eau, constitué de : un élément conducteur d'âme en métal, un élément diélectrique autour du conducteur d'âme basé sur trois couches, la première couche étant appliquée sur le conducteur sous la forme d'un film d'épaisseur uniforme basé sur un polyéthylène basse densité mélangé à un adhésif vinylique ou acrylique, la deuxième couche étant basée sur un mélange de polyéthylène expansé consistant en du polyéthylène basse densité ou un mélange de polyéthylènes basse, moyenne et haute densité et un agent gonflant basé sur l'azodicarbonamide, le p-toluène sulphonyle hydrazide ou le 5-phényle tétrazole, et en option une couche de renforcement ayant les mêmes caractéristiques que la première couche ; **caractérisé en ce qu'il** possède un deuxième élément conducteur externe formé d'une bande constituée d'un alliage d'aluminium ou de cuivre ou combiné à d'autres éléments et entourant ledit conducteur, constitué d'un élément protecteur contre la pénétration d'eau qui le maintient sec et est basé sur une ou plusieurs fibres ou bandes gonflantes formées de fils de polyester ou d'autres fibres gonflantes ; et la couverture protectrice est basée sur du polyéthylène basse, moyenne ou haute densité ou sur une combinaison de ceux-ci.
- 30 2. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** le conducteur d'âme est un film d'aluminium plaqué de cuivre, d'une section circulaire uniforme de $3,15 \pm 0,03 \text{ mm}$ de diamètre.
3. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** le composant adhésif est choisi entre l'acide d'éthylène acrylate ou l'acide d'éthylène vinylique, permettant une meilleure adhérence et une meilleure résistance à l'eau entre le conducteur d'âme et l'élément diélectrique.
- 45 4. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** le deuxième film de polyéthylène appliqué sur le conducteur d'âme présente une meilleure imperméabilité à l'eau que le diélectrique gonflant, améliore son aspect de surface et présente un diamètre de $13,0 \pm 0,10 \text{ mm}$.
- 50 5. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** le conducteur extérieur formé d'une bande constituée d'un alliage d'aluminium ou de cuivre ou d'un mélange de ceux-ci est formé en un tuyau cylindrique et peut être soudé longitudinalement, extrudé, ou ses bords peuvent se chevaucher, et il présente une épaisseur de $0,34 \text{ mm}$ et le diamètre du tuyau est de $13,70 \text{ mm} \pm 0,10 \text{ mm}$.
- 55 6. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** l'élément protecteur contre la pénétration de l'eau consiste en des bandes gonflantes placées en hélice, de façon annulaire ou longitudinalement.

7. Câble coaxial sec selon la revendication 6, **caractérisé en ce que** les éléments de protection contre l'humidité présente une vitesse d'absorption de ≥ 15 ml/g par minute et leur capacité d'absorption est supérieure à 30 ml/g.
- 5 8. Câble coaxial sec selon la revendication 1, **caractérisé en ce que** la couverture extérieure est de préférence constituée de polyéthylène noir moyenne densité et a un diamètre sur la couverture de $15,5 \text{ mm} \pm 0,10 \text{ mm}$ avec une épaisseur de $0,67 \text{ mm} \pm 0,02 \text{ mm}$.
- 10 9. Procédé de fabrication du câble coaxial sec selon l'une des revendications 1 à 8, consistant en les étapes suivantes :
préparation d'une bobine d'alimentation en conducteur d'âme en soudant son extrémité sur une autre bobine, de sorte que la fabrication peut être continue, passage du conducteur d'âme sur une première application de film de polyéthylène par extrusion, le polymère étant choisi parmi le polyéthylène, le polyester ou le polypropylène mélangé à un adhésif à l'acide d'éthylène acrylate ; extrusion, à partir d'un mélange de polyéthylène haute, basse ou moyenne densité avec un agent gonflant tel que l'azodicarbonamide, le p-toluène sulphonyle hydrazide ou le 5-phényle tétrazol avec une injection de gaz inerte à haute pression pour améliorer l'expansion cellulaire, en option d'un deuxième
15 film ayant les mêmes caractéristiques que le premier par co-extrusion ; refroidissement à la température ambiante ; l'âme obtenue est enroulée et un conducteur extérieur en forme de tuyau composé d'aluminium, de cuivre ou d'une combinaison des deux est appliqué, ledit tuyau peut être formé par soudage, ou chevauchement de ses bords ou par extrusion ; application d'un élément hélicoïdal, annulaire ou longitudinal de protection contre la pénétration de l'eau et application de la couverture protectrice par extrusion de polyéthylène basse, moyenne ou haute densité ou
20 d'une combinaison de ceux-ci.
- 25 10. Procédé de fabrication du câble coaxial sec selon la revendication 9, **caractérisé en ce que** l'âme peut être fabriquée par une triple co-extrusion dans trois extrudeuses, une pour le premier film, une autre pour l'isolation principale et l'autre pour le deuxième film, qui sont reliées à une tête d'extrusion.

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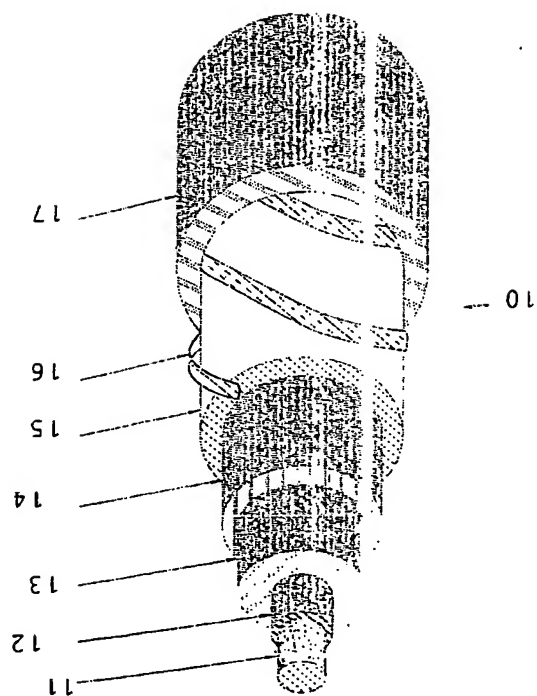


FIG. 1

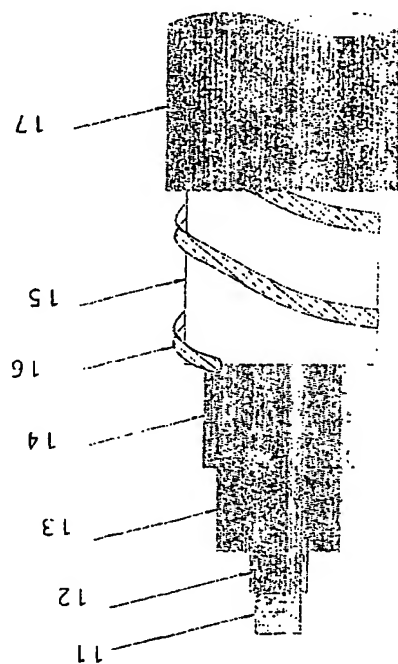
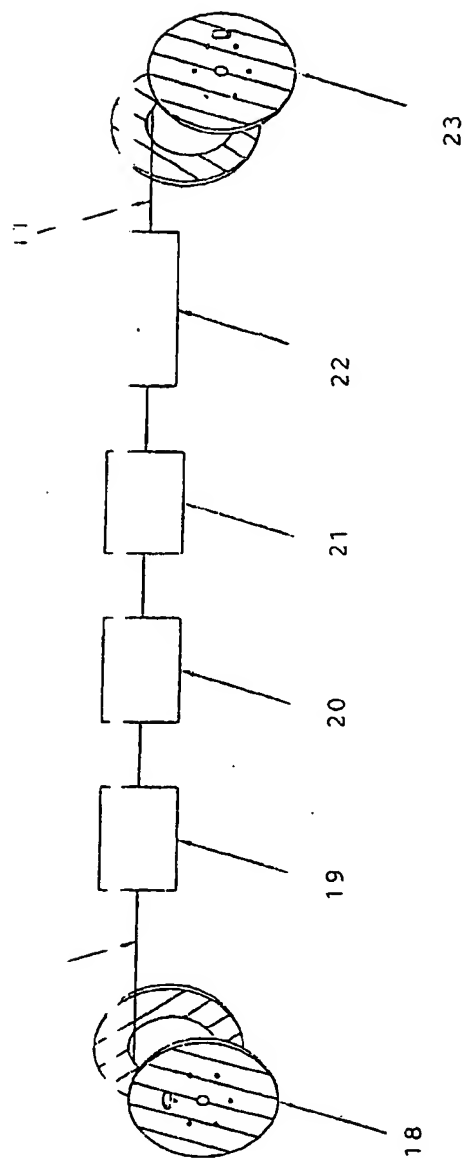
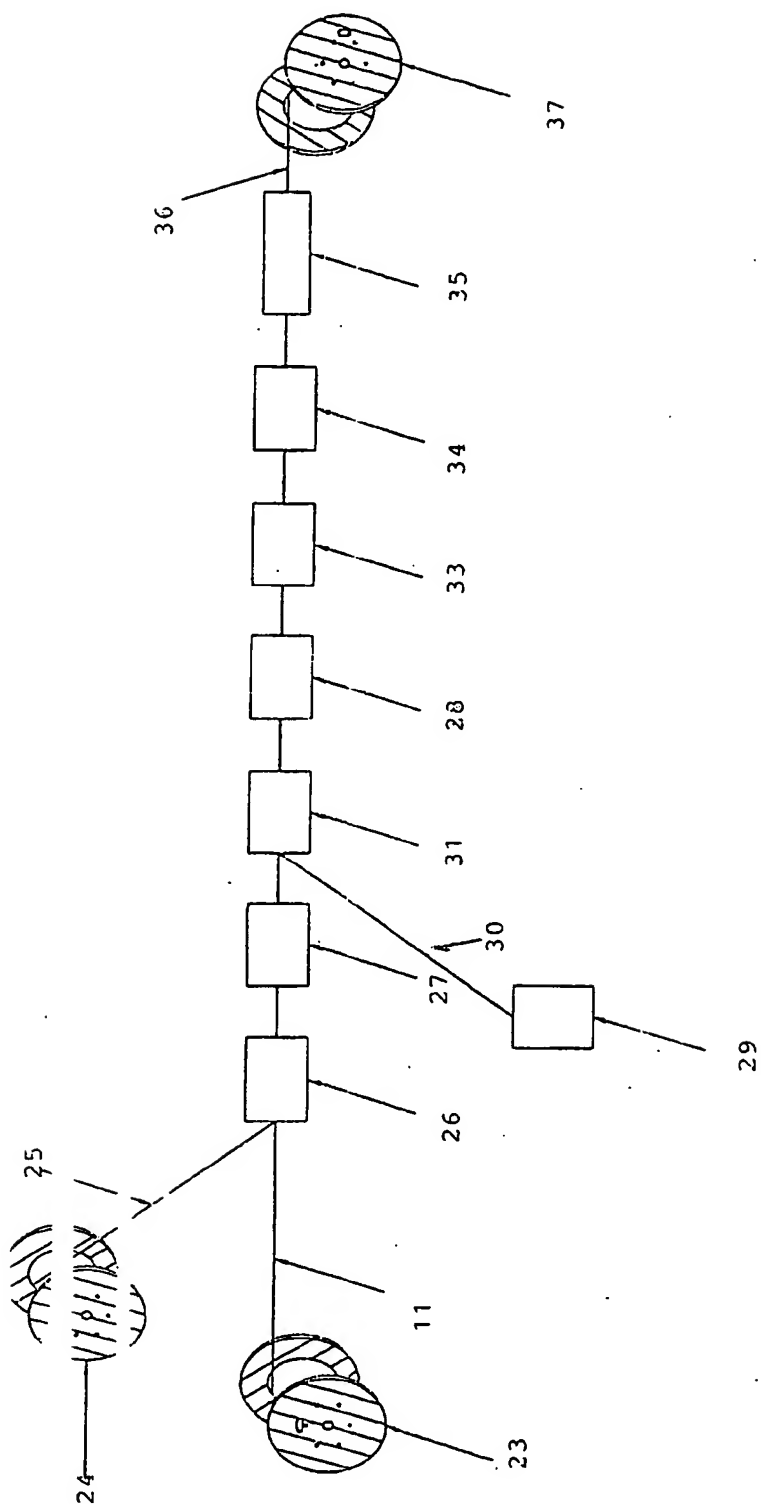


FIG. 2







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(54) **Dry water-resistant coaxial cable and manufacturing method of the same**

(57) Dry coaxial cable resistant to water penetration, made of a core conductor, a dielectric element based on three layers of polymers, and an external conductor

and an extruded cover, characterized because it has swellable protecting elements against water penetration placed between the external conductor and the protective cover.

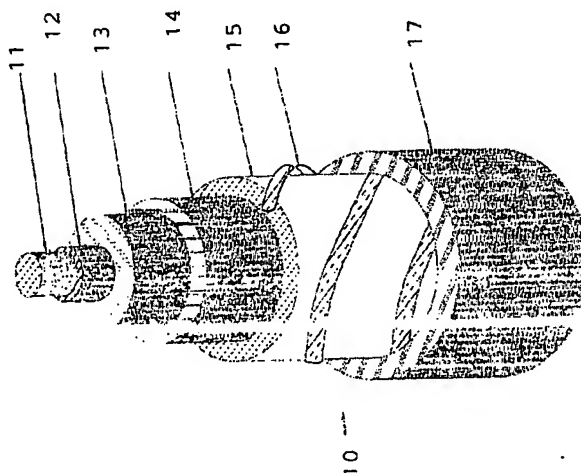


FIG. 1



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EUROPEAN SEARCH REPORT

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| Place of search | | Date of completion of the search | Examiner |
| The Hague | | 26 October 2005 | Demolder, J |
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